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PDES APPLICATION PROTOCOL SUITE FOR COMPOSITE (PAS-C)

FUNCTIONAL NEEDS/STATE-OF-THE-ART COMPARISON FOR THE PAS-C PROGRAM

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This technical report has been reviewed and is approved for publication.

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Project Manager

9 JULY 92
DATE

Bruce A. Rasmussen

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8 July 92
DATE

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THIS DOCUMENT FOCUSES ON REFINING THE FUNCTIONAL NEEDS OF THE PAS-C PROGRAM, CORRELATING THESE COMPOSITE PART INFORMATION EXCHANGE NEEDS TO RESOURCES IN THE PDES/STEP INFORMATION MODELS, AND PRIORITIZE THE ADDRESSING OF THE VOIDS IDENTIFIED DURING THE COMPARISON. THE COMPARISONS AND PRIORITIZATION PROVIDE INSIGHT INTO THE BREADTH OF THE PRELIMINARY SCOPES OF THE APPLICATION PROTOCOLS FOR THE PAS-C PROGRAM.

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AAM	Application Activity Model
ACSP	Aircraft Composite Structural Part
AECO	Advanced Engineering Change Order
AIM	Application Interpreted Model
ALC	Air Logistics Center
AP	Application Protocol
ARM	Application Reference Model
AS	Application Protocol Suite
BOM	Bill of Materials
BREP	Boundary Representation
CAD	Computer Aided Design
CAE	Computer Aided Engineering
CAGE	Contractor And Government Entity
CAM	Computer Aided Manufacturing
CD	Committee Draft
CIM	Computer Integrated Manufacturing
CSL	Contoured Skin Laminate
CSP	Core Stiffened Panel
D&T	Dimensioning & Tolerancing
DBMS	Data Base Management System
DDMC	Defense Depot Maintenance Council
DIS	Draft International Standard
DMMIS	Depot Maintenance Management Information System
DoD	Department of Defense
ECN	Engineering Change Notice
ECP	Engineering Change Proposal
EDCARS	Engineering Data Computer Assisted Retrieval System
EDSC	Engineering Data Service Center
EMD	Engineering Manufacturing Development
FEA	Finite Element Analysis
FEAC	Finite Element Analysis Control
FEAM	Finite Element Analysis Model
FEAR	Finite Element Analysis Results
FFIM	Form Features Information Model
FSD	Full Scale Development
FW/BB	Framework/Building-Block
GOSET	Operational Group for the Standard for Exchange and Transfer
HoQ	House of Quality
ICOM	Input, Control, Output, Mechanism
ICP	Inventory Control Point
IPIM	Integrated Product Information Model
IPO	IGES/PDES Organization

IRB	Industry Review Board
ISO	International Organization for Standardization
ManTech	Manufacturing Technology
NBS	National Bureau of Standards
NC	Numerical Control
NIST	National Institute of Standards and Technology
NSN	National Stock Number
O&S	Operation & Support
P&IC	Production & Inventory Control
PALT	Procurement Administrative Lead Time
PAS-C	PDES Application Protocol Suite for Composites
PD	Product Data
PDD	Product Definition Data
PDES	Product Data Exchange using STEP
PMAG	Project Management Advisory Group
QA	Quality Assurance
QFD	Quality Function Deployment
RAMP	Rapid Acquisition of Manufactured Parts
RDB	Requirements Data Bank
RFP	Request for Proposal
SDAI	STEP Data Access Interface
SM-ALC	Sacramento Air Logistics Center
SOTA	State-of-the-Art
SOW	Statement of Work
SPO	System Program Office
SQL	Structured (or Standard) Query Language
STEP	Standard for the Exchange of Product Model Data
TCA	"T" Composite Assembly
TD	Technical Data
VIG	Vendor Implementation Group
WG	Working Group
WSN	Wirth Syntax Notation

1 INTRODUCTION

There are many challenges in developing standards that determine such items as formats, methodologies, and organization for data exchange, especially in the realm of emerging technology areas such as composites. One of the major managerial challenges in creating a PDES Application Protocol Suite for Composites (PAS-C) development strategy is to find the appropriate mix of elements where government, industry, and vendors can contribute and benefit. The greatest technical challenge is creating a development strategy where many diverse informational views pertaining to one piece of information are identified and then similarities distinguished to make a core of generic sharable information. The focus of this document is to refine the functional needs identified in *Functional Needs IDEF0 Activity and Information Needs for the PAS-C Program* [1], to correlate these composite part information exchange needs to resources in the PDES/STEP information models, and to prioritize the addressing of the voids identified during the comparison. The comparisons and prioritization provide insight into the breadth of the preliminary scopes of the Application Protocols (APs) for the PAS-C Program.

1.1 PAS-C Program Overview

The PAS-C Program addresses two critical national technologies - composites and product data exchange tools. Each of these emerging technologies exist in a dynamic environment. Not only are there fast paced technical changes, but there are also frequent changes in the organizations involved in formulating the technology. PAS-C has developed a set of approaches that will maximize the success of the PAS-C Program and minimize the risks associated with the changes that are on going in both the technology and the environment.

The awareness of the current PDES/STEP and composites environments and the ability to function effectively within those environments is critical to the success of the PAS-C Program. Composite information contains unique requirements, with both detail and assembly, and with material and process information closely intertwined. The complexity and volume of product data associated with a composite part is usually much greater than other types of parts.

The PAS-C Program has structured a unique technical approach for developing an Application Protocol Suite (AS) for composites. This Framework/Building-Block (FW/BB) methodology is designed to address the integratibility, extensibility and nesting of Application Protocols (APs). The building blocks shown in Figure 1 can be reused on multiple APs. After validation on PAS-C, this methodology will be a proven technique to implement Application Protocol Suites.

The approach being used in conducting the PAS-C Program is designed to maximize the consensus within the communities (composites, standards, software applications and government) with regard to the following PAS-C products: Composite Needs Analysis, PDES State-of-the-Art (SOTA) Assessment, PDES Voids, AS Development Strategies, AS Test and Demonstration

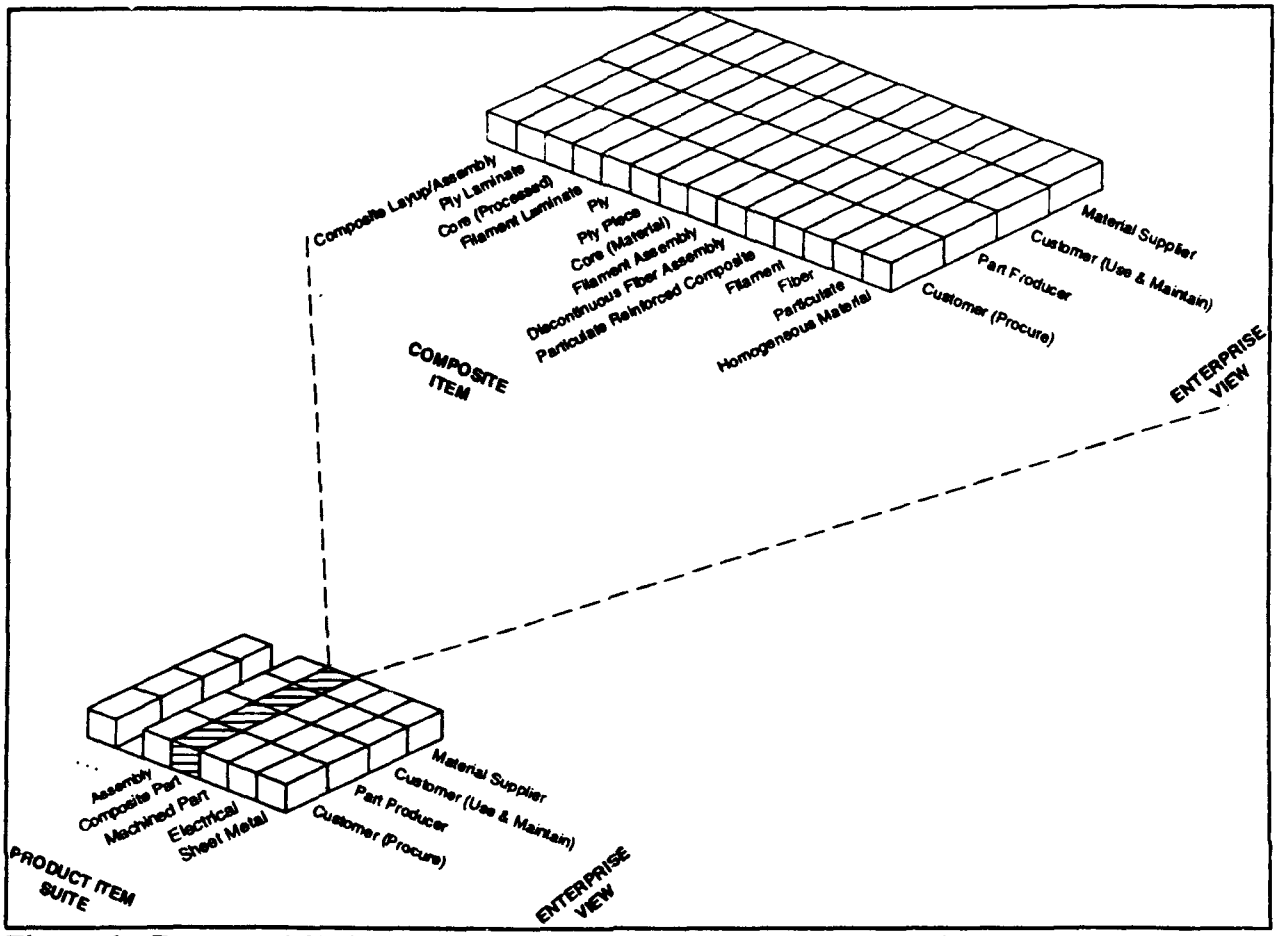

Figure 1 Framework/Building-Block Structure for Composites Application Protocol Suite

Criteria, Application Reference Models (ARMs) and Application Interpreted Models (AIMs). Achieving a consensus in these areas is important to the approach. An integrated set of activities is being utilized to achieve the greatest consensus possible in the least amount of time.

A goal of the PAS-C Program is to stimulate vendors to develop a set of software applications that will be used by the composites manufacturers. Several of the most important activities in the approach are:

- The IPO Composites Committee and other IPO/ISO committees to review and approve the SOTA, Application Activity Models (AAMs), ARMs, and AIMs,

- The Framework/Building-Block methodology for developing Needs Analysis and models,

- Industry Review Board and Vendor Implementation Group participation in developing the priority of voids, AS Strategy, Test and Demonstration Criteria and the demonstrations,

- Design of a risk management strategy based on consensus building among the industry, vendor, government and standards communities,

- Technology transfer centered on achieving concurrence with and ownership of the AS results of the program throughout all communities.

The Air Logistics Centers (ALCs) are being encouraged to participate at the onset of the program. Through the Vendor Implementation Group (VIG), vendors will understand the business case and be encouraged to develop commercial tools. The Industry Review Board (IRB) provides a forum for the Air Force, Industry, and the PDES community to review the progress of the PAS-C Program and provide guidance.

The PAS-C Program schedule consists of completing the PAS-C Program within 52 months and is divided into three phases. Air Force approval is required before commencing effort on Phases II and III. This schedule contains a 12 month duration for Phase I, a 24 month duration for Phase II, and a 12 month duration for Phase III. This is followed by a 4 month period for conducting the Industry/Government Debriefing and final report preparation and review.

Figure 2 provides the overall program roadmap. Output from each Phase provides the needed input to the next successive Phase. The results of the Needs Analysis tasks performed in Phase I form the basis for developing the Application Protocol Suite. Up to three Application Protocols are anticipated for the AS developed in Phase II. The schedule reflects the proposed development times for the ARM, AIM, and Testing Criteria for each of these Application Protocols. Phase III will use the AS developed in Phase II for a demonstration.

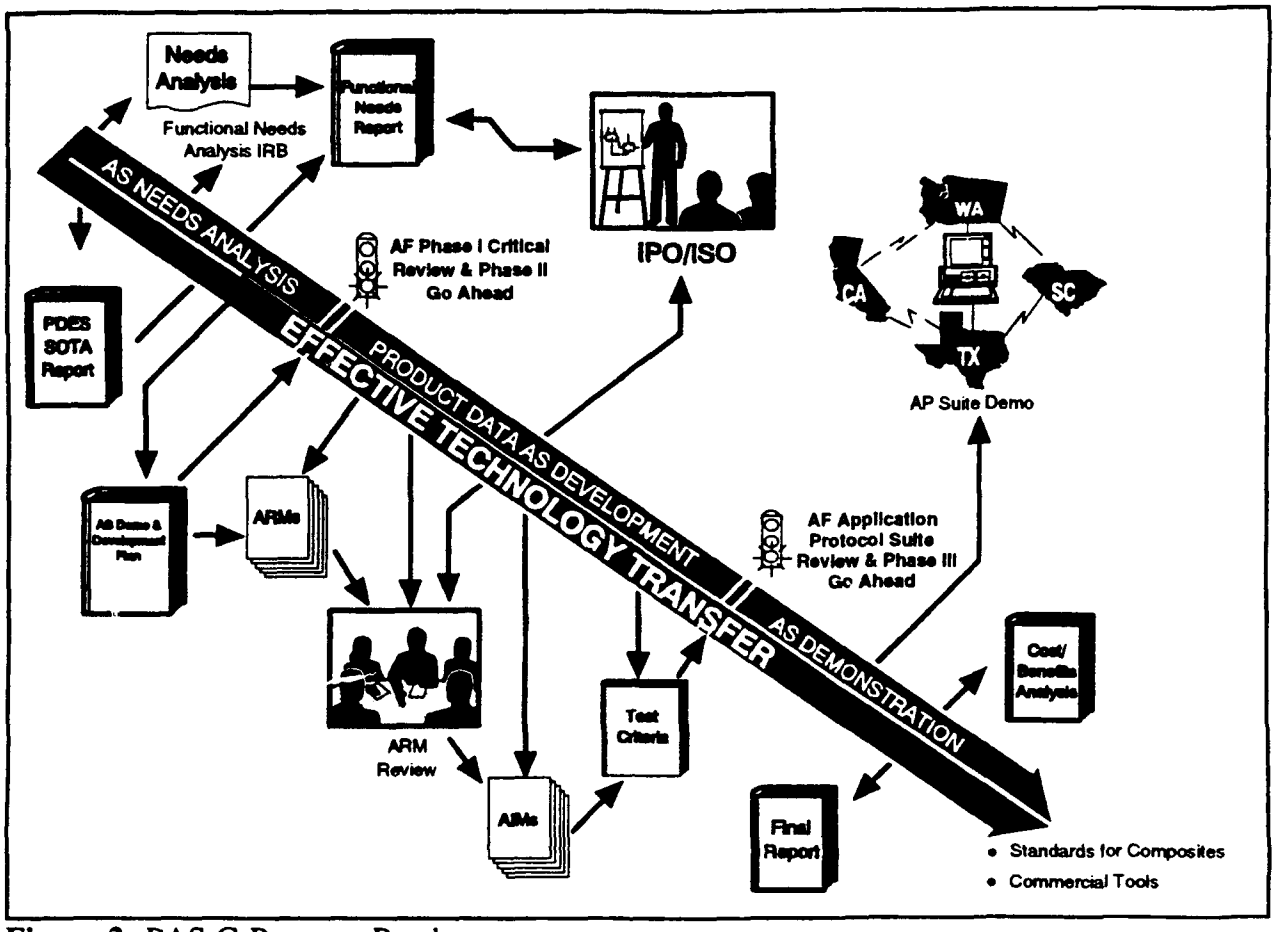

Figure 2 PAS-C Program Roadmap

1.2 Program Organization

The PAS-C Program organization is shown in Figure 3. An important part of the PAS-C Program is the Industry Review Board (IRB) which is comprised of both industry and government representatives (Composites Automation Consortium, Inc., DARPA, General Motors, IPO, Lockheed, Navy, Northrop and Universal Technologies). The IRB convenes at Air Force scheduled reviews to receive progress reports of the effort and offer guidance to the program team. The team is also aided by the Risk Management Board, made up of senior executives from the participating companies. This board meets periodically to provide advice on quality and risk management.

Another important aspect of the program organization is the Vendor Implementation Group (VIG). This group interacts with the team continuously to insure that the development of implementation tools (e.g., translators) is incorporated into its business strategy. The AS development tasks are performed by a team of composites and PDES/STEP experts from Boeing, General Dynamics and LTV.

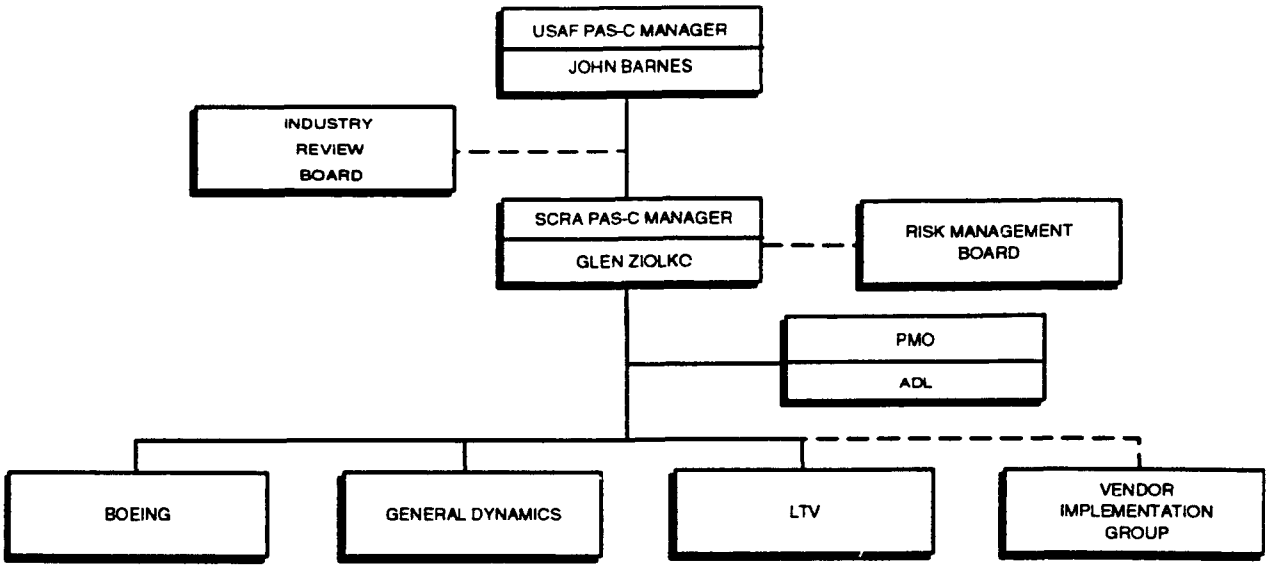

Figure 3 PAS-C Program Organization

1.3 Document Objectives

There are three major objectives of this document. The first objective is to record the refinement of the functional needs that were documented in reference [1]. Secondly this document records the correlation of these composite part information exchange needs to the available resources in the PDES/STEP information models. Finally, this document records the prioritization of the information exchange capability voids identified during the comparison. The body of this document is divided into four sections:

2 METHODOLOGY

Defines the overall methodology for performing the refinement of the needs analysis, and for creating and interpreting the Quality Function Deployment (QFD) technique House of Quality (HoQ) assessment of information needs to PDES/STEP and PAS-C resources.

3 NEEDS REFINEMENT

Contains the documentation of the refined information needs and their relationship to the activity models.

4 CORRELATION OF COMPOSITE AND APPLICATION INFORMATION NEEDS TO PDES/STEP INFORMATION MODELS

Contains the documentation of the WHAT (Information Needs) versus HOW

(PDES/STEP Parts and their Schemas) matrix of the HoQ.

5 NEEDS TO VOIDS CORRELATION AND PRIORITIZATION

Contains the documentation of the WHAT (Information Needs) versus WHY (Importance of Needs) matrix, and the HOW MUCH (Development Tasks) versus HOW (PDES/STEP Parts and their Schemas) of the HoQ. Also contains the assessment of which voids are to be addressed by the PAS-C Program, or by the PDES/STEP community, and the coordination of those efforts.

These refinements, comparisons and prioritizations are used in the document *Scoping and Benefits Criteria (Volume II) for the PAS-C Program* [2] to set the preliminary scopes of the Application Protocol Suite.

2 NEEDS vs. STEP COMPARISON METHODOLOGY

2.1 Composites and Application Needs Analysis Refinement

The information needs documented in *Functional Needs IDEF0 Activity and Information Models for the PAS-C Program* [1] required update and refinement to reflect the current state of the PAS-C Program. Several of the terms and definitions have been updated, and several FW/BB views added. However, the key activity of the needs refinement is the forging of a relationship between the needs (characteristics) and the IDEF0 activity models. These relationships assure that the information documented by the two methods is consistent. The methodology of forging these relationships is a three step iterative process:

1. Review the characteristics list and associate each characteristic with node(s) in the IDEF0 activity model.

2. Add information needs (characteristics) to the FW/BB view that are required by the associated IDEF0 activities.

3. Add information needs (characteristics) that have been established from activities beyond those documented in reference [1]. These will primarily come from the evolving AP scope statements and external reviews.

The refined needs are then sorted and combined for input to the WHATs column in the House of Quality (HoQ) tables. The HoQ and Quality Function Deployment methodologies are discussed in the following sections.

If any of the revised characteristics do not have corresponding activities or ICOMs, the activities will be added to the existing activity models during the development of the Application Activity Models during the beginning of AP development in Phase II.

2.2 Quality Function Deployment (QFD)

2.2.1 Overview of QFD

Quality Function Deployment (QFD) was developed to consider quality early in the design process. The method focuses on identifying requirements or objectives and then focusing development efforts on satisfying those requirements that yield the best return on investment. QFD is a simple method that appears complex when first introduced. The perception of complexity arises from the utilization of the primary QFD tool, the House of Quality chart. Figure 4 illustrates the HoQ used by the PAS-C team.

WHATs: A typical QFD analysis begins with the identification of the requirements/objectives (WHATs). This list is developed based upon pre-defined requirements or a collection of the "voice of the customer". WHATs are listed along the left hand side of the central matrix of the house of quality. For PAS-C, the needs analysis effort provided the "needs" for the program.

HOWs: The methods that can be used to satisfy the WHATs are referred to as HOWs. This list is usually referred to as quality characteristics. However, in the case of PAS-C, the hows are pre-defined to be the elements of the STEP standard.

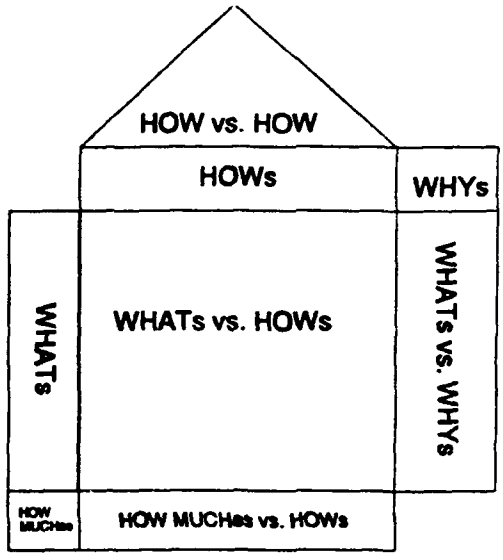

Figure 4 The House of Quality pulls all of the QFD elements together.

WHYs: The right hand side of the central matrix are the WHYs. In a typical QFD analysis WHYs describe the market, e.g. why this product is needed (i.e., market niche). This is usually presented as customer groups that the product must satisfy. The PAS-C team utilized the WHY category as a list of benefit or success criteria for the program.

HOW MUCHes: HOW MUCHes are a list of the technical description of the market place. It includes priority information and targets or goals for the HOWs. As part of the PAS-C methodology, this category was used to assess the technical effort required to fill the identified composites' voids in STEP.

WHATs vs. HOWs: This is a correlation matrix in the center of the central matrix that defines how well the HOWs listed satisfy the WHATs. It is in this matrix that the level of ability to satisfy the needs is established. The PAS-C team utilized this matrix to identify the voids within STEP. The team used this analysis to assess the specific portion of the standard that would need to be worked to fill the void.

WHATs vs. WHYs: The right hand side matrix of the house is used to prioritize the WHATs. This is typically based upon marketing information that defines what the different customer groups perceive as important. The PAS-C team utilized this matrix to prioritize the PAS-C needs based upon their contribution to the success of the program and/or benefit of filling the void.

HOW MUCHes vs. HOWs: The bottom matrix of the house is typically used to define an objective means to assure that requirements have been met. The PAS-C team did not utilize this matrix, but rather used data in the WHAT vs. WHY matrix to assess and document the developmental costs associated with filling each void.

2.2.2 PAS-C Application of QFD

The PAS-C team utilized a computer based tool QFDCapture[1] to facilitate the creation and management of the data generated during the analysis phase. In attempting to apply the QFD method and tool to the task at hand, the PAS-C team modified the methodology. This section describes those modifications and a description of how to interpret the QFD analysis information presented in the rest of this document.

2.2.2.1 WHATs vs. HOWs

The PAS-C team utilized this matrix to identify the voids within STEP. The team used this analysis to assess the specific portion of the standard that would need to be worked to fill the void. One benefit to the PAS-C goals is that a high level mapping of PAS-C entities to STEP was performed and documented within the QFD data base. This report discusses the WHATs vs. HOWs analysis portion of the PAS-C QFD analysis activity.

2.2.2.1.1 Mapping needs to STEP -- "The Comparison"

The process of mapping the needs to STEP capabilities involved reviewing the requirements listed in the *Functional Needs Report for the PAS-C Program* [3] and comparing those with the entity and schema content of the various STEP Parts. Those Parts and their Schemas that mapped to a PAS-C need were documented based upon the degree with which the data intent and structure of STEP satisfied the need.

The comparison results were documented in the HoQ matrix. The strength of the relationship received a value rating illustrated in Figure 5. A value of 9, or filled circle, indicates that the information requirement is strongly satisfied by that STEP Part. An open circle, value of 3, represents that the need is partially satisfied, but that Part is deemed as partially deficient in fulfilling the need. Voids are identified with a triangle, value 1, indicating that there is a potential match in name only and not in data content. A value of negative one, -1, indicates that the Part does not satisfy any of the PAS-C information need and probably should. The far right hand side of the HOWs lists "Void to be filled by Composite Resource Model". In each case where it was decided that a significant void remained which is outside the scope of any of the STEP Parts, a value of nine was assigned indicating that the composite resource model should be utilized to fill the void.

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[1] QFDCapture is a trademark of International TechneGroup Incorporated.

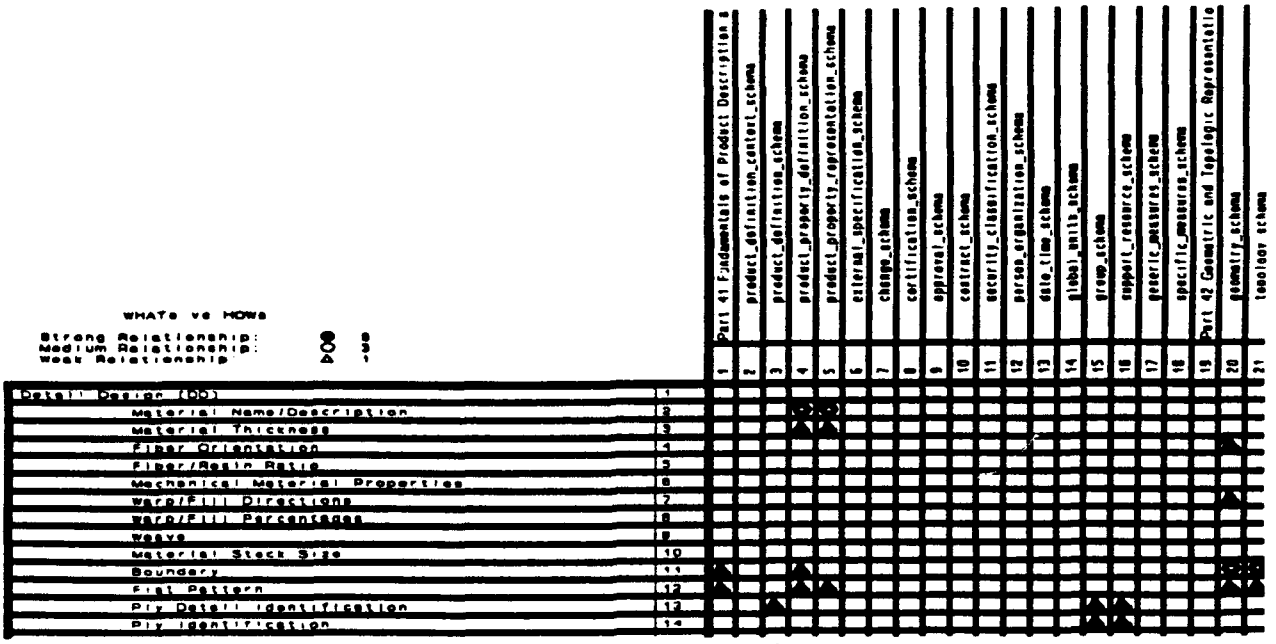

Figure 5 QFD compares PAS-C needs to STEP capabilities

2.2.2.1.2 Identifying Voids

The voids potentially to be addressed by the PAS-C Team are those areas of the matrix which have a triangle, value of 1, or a value of -1. Each matrix cell under "Void to be filled by Composite Resource Model" with a value of -1 are voids that should potentially be addressed by the PAS-C effort. The determination of which voids to fill is a function of how much effort is required to fill the void, what is the payback to PAS-C in filling the void, and the PAS-C resource limitations. The QFD process provides the methodology to relate these three components to each void identified.

2.2.2.2 HOW MUCHes vs. HOWs

The HOW MUCHes vs. HOWs was not populated. Instead, a Cost to Fill Void column was incorporated in the WHATs vs. WHYs matrix in order to assess the development activities and effort required to fill the voids.

2.2.2.3 WHATs vs. WHYs

The WHATs vs. WHYs matrix analyzes the PAS-C needs versus certain quantifiable aspects of the criteria that determine the success of the PAS-C program. The analysis provides a method to prioritize those needs based upon importance to the program success. The complete WHATs vs. WHYs analysis is provided later in this document.

2.2.2.3.1 Prioritizing Needs

The first column of the WHYs was determined by taking the WHATs (i.e. needs) and determining what percentage of the total activity for the subject area the WHAT had a bearing on. This column gives an indication of the time that the subject area utilized this data. The second column of the WHYs was determined by taking the percentage improvement that the domain expert thought a PDES/STEP implementation could have on their subject area and applying it to the WHATs. This data was formulated during the refinement of the data in the needs analysis discussed in Section 3. Figure 6 illustrates a ranking within the QFD House of Quality for these two different methods of prioritization. This prioritization provides an indication where possible payback could be realized.

2.2.2.3.2 Estimating the Cost to Fill Voids

The cost of filling the voids is identified in the Cost to Fill Void Column. The value is in terms of a normalized cost unit, labor hours. These values represent the cost estimate to perform each void filling task.

2.2.2.3.3 Prioritizing Voids by Cost vs. Benefit

Of key interest to the PAS-C Program is the cost benefit potential of filling each void identified during the needs comparison task. The combined ranking and rating of each need is coupled with the cost of filling the need. The result is a focused development activity directed towards the key areas of success and high benefit. The fourth column (CBA Ratio) gives the ratio of the cost (third column) to the benefit in the second column.

Detailed Structural Design
Whats vs. Whys

Last Updated: 20 May 92
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		Weighting	Percent Utilization	Percent Improvement	Cost to Fill Void	CBA Ratio	Cost to Include into AP3	Inverse Normalized Cost	Normalized Utilization	Normalized Improvement	Normalized Cost to Fill Void	Weighted Avg Importance of Void	Rank of Wgt'd Importance of Void	Inverse Normalized Cost	Normalized Cost to Include in AP	Weighted Avg of Importance in AP	Rank of Wgt'd Importance in AP
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			0.30	0.20	0.50	0.00	0.50	0.50	0.30	0.20	0.50	0.00	0.00	0.50	0.00	0.00	0.00
Fastener Holes & Cut Outs	1		62.9	0.00			105		20	0		6.01	1	0.27	3.	6.15	1.	1
Configuration Control Information	2		16.0	1.00			105		5	10		3.58	2	0.27	3.	3.72	3.	2
Mold/Bag Line Surface	3		28.7	0.27			35.		9	3		3.38	3	0.82	1.	3.80	2.	3
Fiber/Resin Ratio	4		10.0	1.00	16	0.0	35.	0.	3	10	2	3.26	4	0.82	1.	3.42	6.	4
Material Name	5		11.8	1.00			35.		4	10		3.18	5	0.82	1.	3.59	4.	5
Material Name/Description	6		11.8	1.00			35.		4	10		3.18	6	0.82	1.	3.59	5.	6
Material Thickness	7		10.0	1.00	32	0.0	35.	0.	3	10	4	3.13	7	0.82	1.	3.42	6.	7
Material Stock Size	8		10.0	1.00			35.		3	10		3.01	8	0.82	1.	3.42	6.	8
Ply Stock Size	9		10.0	1.00			35.		3	10		3.01	8	0.82	1.	3.42	6.	9
Tolerances	10		12.3	0.36	32	0.0	70.	0.	4	4	4	2.05	10	0.41	2.	2.13	10	10
Tooling Interface Information	11		5.40	0.54	25	0.0	35.	0.	2	6	3	1.78	11	0.82	1.	2.03	12	11
Laminate Thickness	12		9.47	0.36			35.		3	4		1.65	12	0.82	1.	2.06	11	12
Next Assembly Information	13		12.7	0.00			70.		4	0		1.21	13	0.41	2.	1.42	13	13
OML/IML Surface	14		4.64	0.27			35.		1	3		0.99	14	0.82	1.	1.40	14	14
Envelope	15		3.51	0.15	16	0.0	35.	0.	1	2	2	0.91	15	0.82	1.	1.07	16	15
Ply Detail Interface	16		3.76	0.19	50	0.0	70.	0.	1	2	6	0.84	16	0.41	2.	0.96	19	16
Ply Stack	17		7.77	0.00	50	0.0	70.	0.	2	0	6	0.82	17	0.41	2.	0.94	20	17
Panel Size	18		7.39	0.00			35.		2	0		0.72	18	0.82	1.	1.13	15	18
Boundary	19		3.51	0.15			35.		1	2		0.66	19	0.82	1.	1.07	16	19
Weight	20		3.98	0.00	16	0.0	35.	0.	1	0	2	0.63	20	0.82	1.	0.79	25	20
Laminate Assembly Process	21		5.83	0.00	125	0.0	175	0.	2	0	15	0.58	21	0.16	6.	0.63	29	21
Ply Detail Location	22		1.94	0.18			70.		1	2		0.58	22	0.41	2.	0.79	24	22
Ply Table	23		5.89	0.00			140		2	0		0.56	23	0.20	4.	0.86	28	23
Percentage (%) Ply Angle/Thickness	24		5.83	0.00			35.		2	0		0.55	24	0.82	1.	0.96	18	24
Damage Tolerance	25		3.88	0.00	25	0.0	35.	0.	1	0	3	0.53	25	0.82	1.	0.78	26	25
Cross-Section Properties	26		3.88	0.00	25	0.0	105	0.	1	0	3	0.53	25	0.27	3.	0.50	40	26
Material Specificaiton	27		5.24	0.00			35.		2	0		0.50	27	0.82	1.	0.91	21	27
Flat Pattern	28		1.57	0.15			35.		1	2		0.47	28	0.82	1.	0.89	22	28
Laminate Patch	29		1.94	0.00	16	0.0	35.	0.	1	0	2	0.43	29	0.82	1.	0.59	31	29
Number of Ply Details	30		1.82	0.00	16	0.0	35.	0.	1	0	2	0.42	30	0.82	1.	0.58	37	30
Joints/Interfaces	31		3.91	0.00	125	0.0	175	0.	1	0	15	0.40	31	0.16	6.	0.45	43	31
Ply Quantities	32		3.94	0.00			35.		1	0		0.38	32	0.82	1.	0.79	23	32
Ply Transition	33		3.88	0.00			35.		1	0		0.37	33	0.82	1.	0.78	26	33
Filler Plies	34		2.11	0.00	25	0.0	35.	0.	1	0	3	0.36	34	0.82	1	0.61	30	34
Strength	35		1.94	0.00	25	0.0	35.	0.	1	0	3	0.34	35	0.82	1.	0.59	31	35

Figure 6 Prioritizing Needs Using the QFD Method

3 COMPOSITES and APPLICATIONS INFORMATION NEEDS ANALYSIS REFINEMENT

The information needs documented in reference [1] have been updated and refined. Several of the terms and definitions have been updated, and several FW/BB views added and documented in this section.

The key activity of the needs refinement has been the forging of a relationship between the needs (characteristics) and the IDEF0 activity models. The refined characteristics tables for Design, Analysis and Manufacturing are presented in Appendices B, C, and D. These refined characteristics are used in Section 4 to populate the WHAT column of the three HoQ's for Design, Analysis and Manufacturing.

3.1 Revised Terminology

The revised functional view names, building block titles and two new building blocks are listed below. These revisions are cross referenced (where possible) with the names and titles as documented in reference [1].

3.1.1 Revised Functional Views

Old: Detail Design
New: Detail Structural Design

3.1.2 Revised Building Block Titles

Old: Detail Structural Analysis - Core Detail
New: Detail Structural Analysis - Core (Material and Processed - Machined)

Old: Detail Structural Analysis - Core Assembly
New: Detail Structural Analysis - Core (Processed - Assembly)

Old: Detail Structural Analysis - Composite Layup Assembly (Core Assembly/Ply Laminate(Flat)/Ply Layup)
New: Detail Structural Analysis - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Detail Structural Analysis - Composite Layup Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Detail (Filler)/Ply Laminate (Cap))
New: Detail Structural Analysis - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Preliminary Structural Analysis - Core Detail
New: Preliminary Structural Analysis - Core (Material and Processed - Machined)

Old: Preliminary Structural Analysis - Composite Layup Assembly (Core Assembly/Ply Laminate(Flat)/Ply Layup)
New: Preliminary Structural Analysis - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Preliminary Structural Analysis - Composite Layup Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Detail (Filler)/Ply Laminate (Cap))
New: Preliminary Structural Analysis - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Structural Test - Composite Layup Assembly (Core Assembly/Ply Laminate(Flat)/Ply Layup)
New: Structural Test - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Structural Test - Composite Layup Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Detail (Filler)/Ply Laminate (Cap))
New: Structural Test - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Detail Structural Design - (Filler)
New: Detail Structural Design - (Tow)

Old: Detail Structural Design - Core - Machined
New: Detail Structural Design - Core (Processed - Machined)

Old: Detail Structural Design - Core - Formed
New: Detail Structural Design - Core (Processed - Formed)

Old: Detail Structural Design - Core - Stabilized
New: Detail Structural Design - Core (Processed - Stabilized)

Old: Detail Structural Design - Composite Assembly Core Stiffened Panel (CSP) - Core/Ply Laminate/Ply Laminate
New: Detail Structural Design - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Detail Structural Design - "T" Composite Assembly - LD Angle/LD (Angle)/Filament Laminate (Filler)/LD (Cap)
New: Detail Structural Design - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Manufacturing Planning - (Filler)
New: Manufacturing Planning - (Radius Filler)

Old: Manufacturing Planning - Core - (Machined)
New: Manufacturing Planning - Core (Processed - Machined)

Old: Manufacturing Planning - Core Assembly
New: Manufacturing Planning - Core (Processed - Assembly)

Old: Manufacturing Planning - Composite Layup/Assembly (Core Stiffened Panel)
New: Manufacturing Planning - Composite Layup Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Manufacturing Planning - Composite Layup Assembly ('T')
New: Manufacturing Planning - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: NC Programming - (Filler)
New: NC Programming - (Radius Filler)

Old: NC Programming - Core - (Machined)
New: NC Programming - Core (Processed - Machined)

Old: NC Programming - Core Assembly
New: NC Programming - Core (Processed - Assembly)

Old: NC Programming - Composite Layup Assembly (Core Stiffened Panel)
New: NC Programming - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: NC Programming - Composite Layup Assembly ('T')
New: NC Programming - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Process Planning - (Filler)
New: Process Planning - (Radius Filler)

Old: Process Planning - Core - (Machined)
New: Process Planning - Core (Processed - Machined)

Old: Process Planning - Core Assembly
New: Process Planning - Core (Processed - Assembly)

Old: Process Planning - Composite Layup Assembly (Core Stiffened Panel)
New: Process Planning - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Process Planning - Composite Layup Assembly ('T')
New: Process Planning - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

Old: Tool Design - (Filler)
New: Tool Design - (Radius Filler)

Old: Tool Design - Core - (Machined)
New: Tool Design - Core (Processed - Machined)

Old: Tool Design - Core Assembly
New: Tool Design - Core (Processed - Assembly)

Old: Tool Design - Composite Layup Assembly (Core Stiffened Panel)
New: Tool Design - Composite Layup/Assembly (Ply Laminate (Flat)/Core/Ply Laminate - Core Stiffened Panel)

Old: Tool Design - Composite Layup Assembly ('T')
New: Tool Design - Composite Layup/Assembly (Ply Laminate (Angle)/Ply Laminate (Angle)/Filament Laminate (Radius Filler)/Ply Laminate (Cap) - "T" Composite Assembly)

3.1.3 Revised Characteristics

Analysis

Old: Ply Detail Normal
New: Ply Piece Normal

Old: N/A
New: Assembly Reference Orientation

Detail Structural Design

Old: Ply Detail Identification
New: Ply Piece Identification

Old: Ply Detail Interface
New: Ply Piece Interface

Old: Ply Detail Location
New: Ply Piece Location

Old: Number of Ply Details
New: Number of Ply Pieces

Old: N/A
New: Make From Core Identifier

Manufacturing

Old: Core Detail Position
New: Core Position

Old: N/A
New: Number of Ply Pieces

3.1.4 Additional Building Blocks

DETAIL STRUCTURAL DESIGN (DSD) - FILAMENT LAMINATE (RADIUS FILLER)		
Filament Laminate Identification	The assigned filament laminate number and description.	A22324
Cross Section	Shape of cross section(s) and area(s).	A223233223133
Length	Length of cross section area(s).	A223233223133
Filament Assembly Constituents	Type and quantity of filament assemblies (ex. Tow) that make up filament laminates.	A22324

DETAIL STRUCTURAL ANALYSIS - FILAMENT LAMINATE (RADIUS FILLER)		
Filament Laminate Identification	The assigned filament laminate number and descriptor.	
Cross Section	The shape of the filament laminate cross-section(s) and area(s).	
Length	The length of the filament laminate cross-section area(s).	
Filament Assembly Constituents	Type and quantity of filament assemblies (ex:tow) that make up the filament laminate.	

3.2 Design

The results of the mappings of the Design data indicated that many of the "building-block" characteristics do not map well to the activity models. The activity models detail the generalized approaches to developing composites designs whereas the characteristics represent details pertaining to aspects of the end-result of designing the characteristics. In other cases, some characteristics mapped to high level activity nodes that were not decomposed into their respective activities therefore the mapping of all similar characteristics point to one high level node and not to the specific activity that would result in the generation of the characteristic. The following information explains the justification for mappings that do not have an exact correlation between the characteristics and activities:

A223233223 Create ACSP Data:

- This section is divided into three sections: TCA, CSL, & CSP. Within this section, only ANGLE, CONTOURED, and FILLER are specifically handled. Types such as FLAT would be included in the characteristic partition called CAP; however, CAP is not

decomposed within the activity models in order to evaluate what its activities entail.

A22323322312 Prepare TCA CAP Design:
- All characteristics of the CAP design are included in one activity node number because the activity models are not decomposed further.

A2232332233221 Resolve CSP Core Edge Band Issues:
- The output of this activity is being expanded to include the core "splice geometry". This expanded definition will allow the design characteristic to be mapped.

A22323335 Attach Filler Plies in Transition Area:
- This activity is being mapped to all characteristics requiring filler plies, even though it is found under "Integrate & Prepare CSP Assembly Drawings". A better mapping would be to some aspect of "detailed individual composite designs".

A22322 Build Model and Drawing Tree:
- This activity needs to have a decomposition activity model because of the projected scope of the Design application protocol.

A22324 Build Parts List:
- This activity needs to have a decomposition activity model because of the projected scope of the Design application protocol.

A226 Manage Configuration of ACSP Data:
- This activity node needs to be decomposed because it exports "configuration managed designs" which correlates to the projected scope of the Design application protocol.

PLY PIECE design category:
- Most characteristics are being mapped to CSL because it is assumed that a contour can also be flat.

PLY design category:
- Most characteristics are being mapped to CSL because it is assumed that a contour can also be flat.

PLY LAMINATE - GENERAL FLAT design category:
- Most characteristics are being mapped to CSL because it is assumed that a contour can also be flat.

PLY LAMINATE - ANGLE design category:
- LAMINATE SYMMETRY does not map to the activity model, but could possibly be mapped to A2222113 (Obtain ACSP Initial Weights and Balances).

PLY LAMINATE - CAP design category:

- Most characteristics from this category are being mapped to A22323322312 (Prepare TCA Cap Design) because this is the furthest the activity model is broken down.

COMPOSITE ASSEMBLY CORE STIFFENED PANEL (CSP) - CORE/PLY LAMINATE/PLY LAMINATE design category:

- Design characteristic "ASSEMBLY SYMMETRY" does not map to the activity model, but possibly could be mapped to A2222113 (Obtain initial Weights & Balances).

The specific Design revised characteristics and activity reference tables are documented in Appendix B.

3.3 Analysis

There were four characteristics added to the Analysis tables. Three of the additions were required after the scopes were reviewed in IPO and ISO committees. The fourth was required after reviewing the ICOMS of the activities referenced by the characteristics documented in reference [1].

ANALYSIS QUALITY/COMPLETENESS characteristic:

The Analysis Quality/Completeness characteristic was suggested during the NAFEMS CAD/FE Data Exchange Working Group (which is a strong supporter of ISO FEA committee) review of the activity models. This characteristic is not supported by the activity model, so there can be no activity reference. The activities needed will be added in Phase II of the PAS-C program during the Application Activity Model (AAM) development phase.

ANALYSIS DECISION DATA and CONFIGURATION CONTROL DATA characteristics:

The Analysis Decision Data and Configuration Control Data characteristics were included upon reviewing the ICOMS of the referenced activities.

LAMINATE PATCH characteristic:

The Laminate Patch characteristic was included during the development and review of the AP Summary Sheet scope statements.

The specific Analysis revised characteristics and activity reference tables are documented in Appendix C.

3.4 Manufacturing

The additional characteristics identified for Manufacturing were for the activity node A231, Plan for Manufacture. This Activity has as outputs Manufacturing, Bill-of-Materials, and Manufacturing Plan. These were not represented in the previous characteristics and were added in this process.

MANUFACTURING BILL OF MATERIALS:

Manufacturing Bill-of-Materials (BOM) is a new breakdown of the parts and materials required to build the part based on the manufacturing process. This BOM often has subassemblies for the major composite items which make up a composite part.

MANUFACTURING PLAN:

The Manufacturing Plan is the high level description of the steps necessary to manufacture the part. Part of the Manufacturing Bill-of-Materials is the ability to specify material to the activity Procure Manufacturing Materials. The two characteristics stock size and material amount were added to be able to do this.

NC PROGRAMMING, PROCESS PLANNING, TOOL DESIGN:

No new characteristics were identified for NC Programming, Process Planning, or Tool Design, the other major functional views considered in scope for this AP.

The specific Manufacturing revised characteristics and activity reference tables are documented in Appendix D.

4 CORRELATION of COMPOSITES and APPLICATION INFORMATION NEEDS to PDES/STEP MODEL

4.1 PAS-C Needs to PDES/STEP Comparison

The composite and application information needs have been correlated to the PDES/STEP Parts and Schemas using the WHAT (Information Needs) vs. HOW (PDES/STEP Parts and their Schemas) matrix of the House of Quality. Three tables have been developed, one each for Detail Structural Design, Detail Structural Analysis, and Manufacturing. Each of the characteristics is correlated to the Part(s) and Schema(s) that contain partial or complete resources to supply entities for the creation of the APs.

4.1.1 Design

Figure 7 documents the WHAT vs. HOW matrix of the Detail Structural Design House of Quality. Sixty-five percent of the Design characteristics are satisfied by the resources within STEP, such that specialization of the entities within the AP will fulfill the need.

Of the fifty-five design characteristics only nineteen were identified to have voids within STEP. It was established that six of these were significant voids in that they did not have any corresponding resources in STEP. The significant voids occurred in areas such as, assembly or interface definition, manufacturing process, and damage tolerance.

Eighteen or thirty-three percent of the design characteristics were strongly supported by STEP. These characteristics dealt mostly with geometry, orientation, product identification, and material.

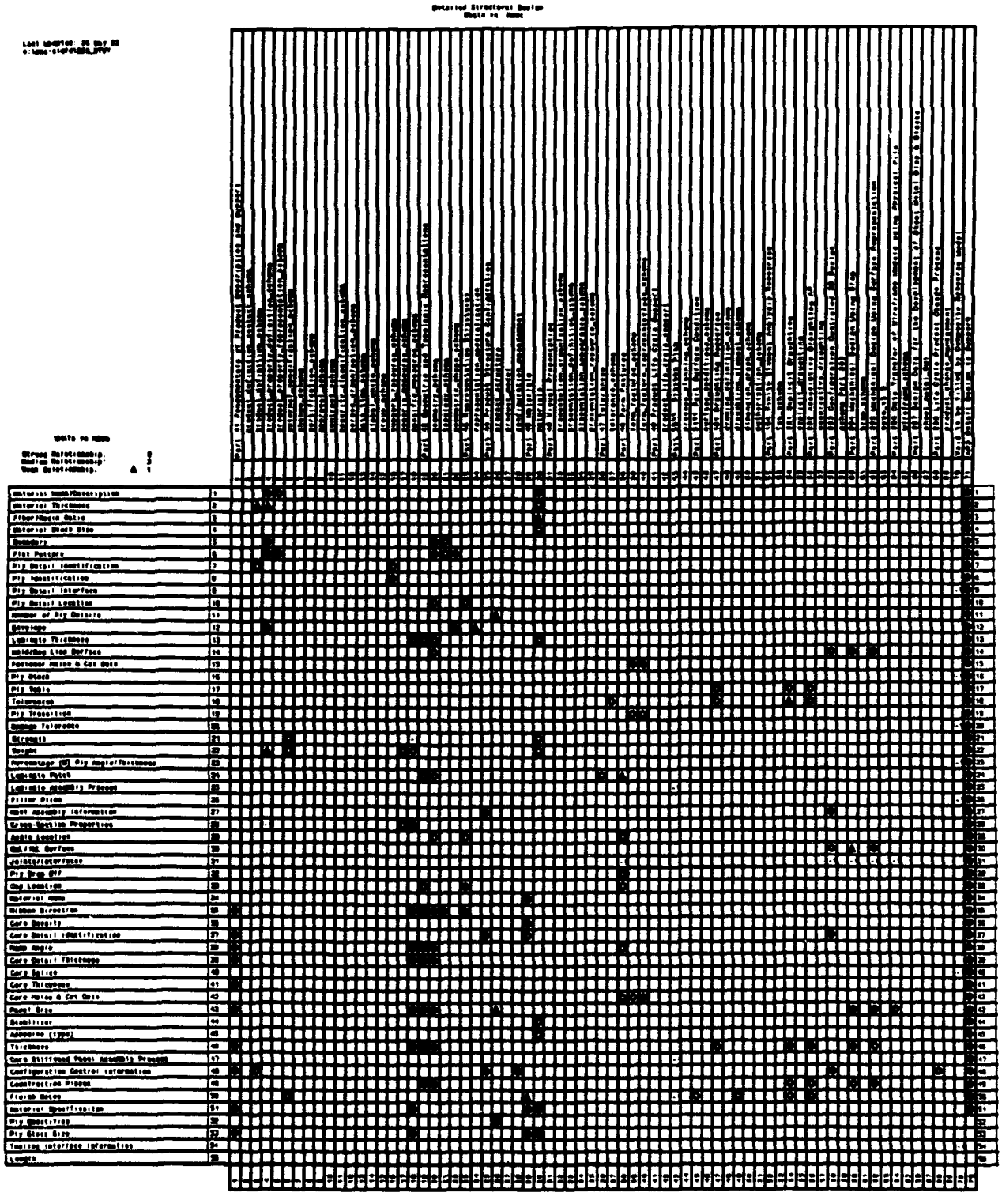

Figure 7 Design Characteristics Mapped to STEP Resources

4.1.2 Analysis

The majority of the analysis characteristics correlated well to the present PDES/STEP resources. Of the forty-six characteristics, only three were judged to be complete voids, with one other judged to be a partial void. In the process of correlating the characteristics to the PDES/STEP resources an assumption was made that the majority of the composite needs could be met by specializing existing resources rather than creating special resources in a Composites information model.

Slightly more than half of the Analysis characteristics turned out to have strong geometric relationships. Of these most were concerned with establishing direction or orientation, the rest concerned mostly boundaries and surfaces.

Figure 8 documents the WHAT vs. HOW matrix of the Detail Structural Analysis House of Quality.

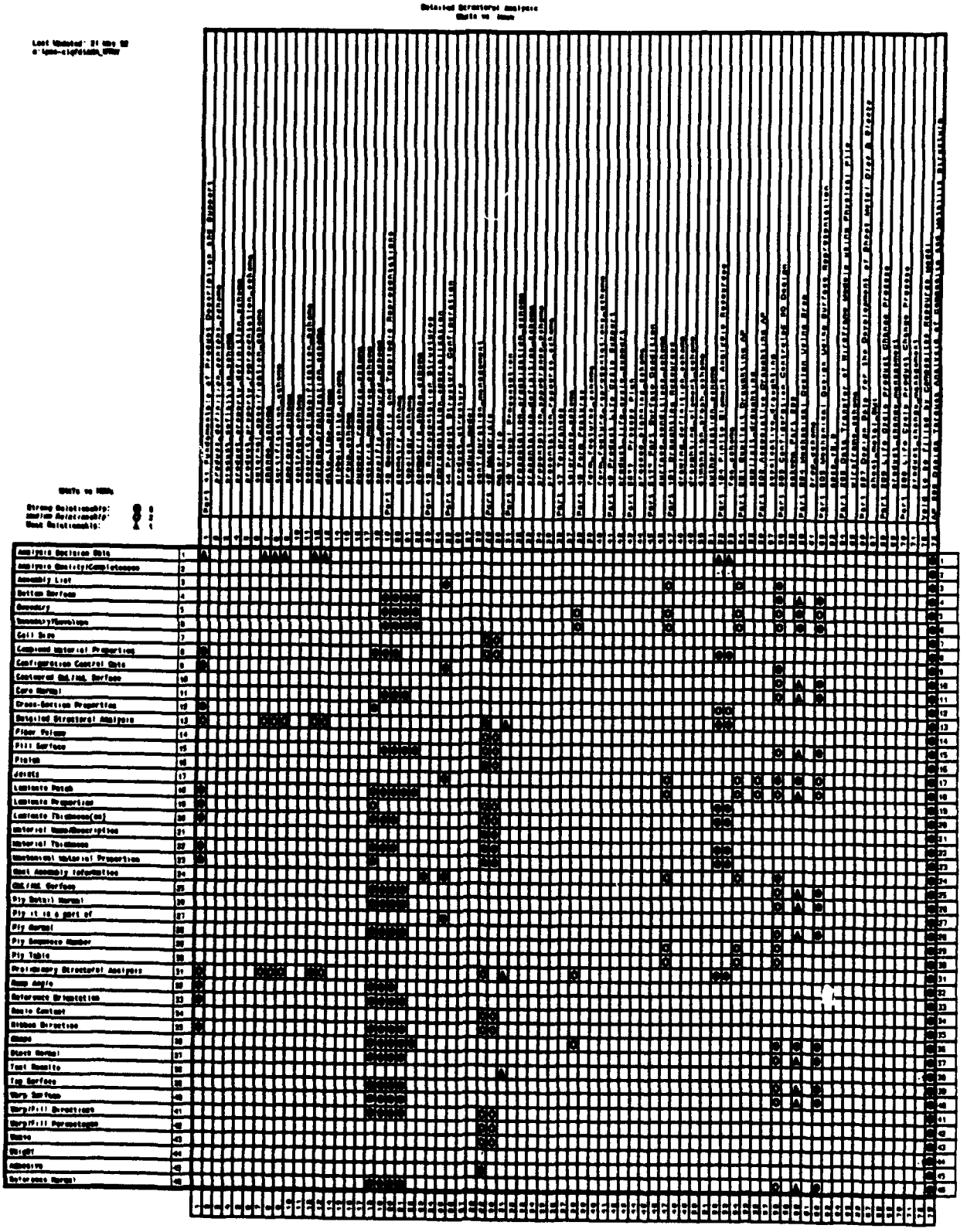

Figure 8 Analysis Characteristics Mapped to STEP Resources

4.1.3 Manufacturing

Approximately half of the manufacturing characteristics correlated well to the present PDES/STEP resources. Of the characteristics, twenty were judged to be significant voids, with twelve others judged to be minimal voids. In the process of correlating the characteristics to the PDES/STEP resources an assumption was made that, from the manufacturing view point, several of these voids could not be met by specializing existing resources (the approach taken when evaluating voids from an analysis and design viewpoint). The use of Application Interpreted Constructs (AICs) from other APs may provide an alternate method for filling these voids. The AIC concept has not been definitized nor implemented at this time. Therefore, this approach will be evaluated for addressing voids during Phase II.

Figure 9 documents the WHAT vs. HOW matrix of the Manufacturing House of Quality.

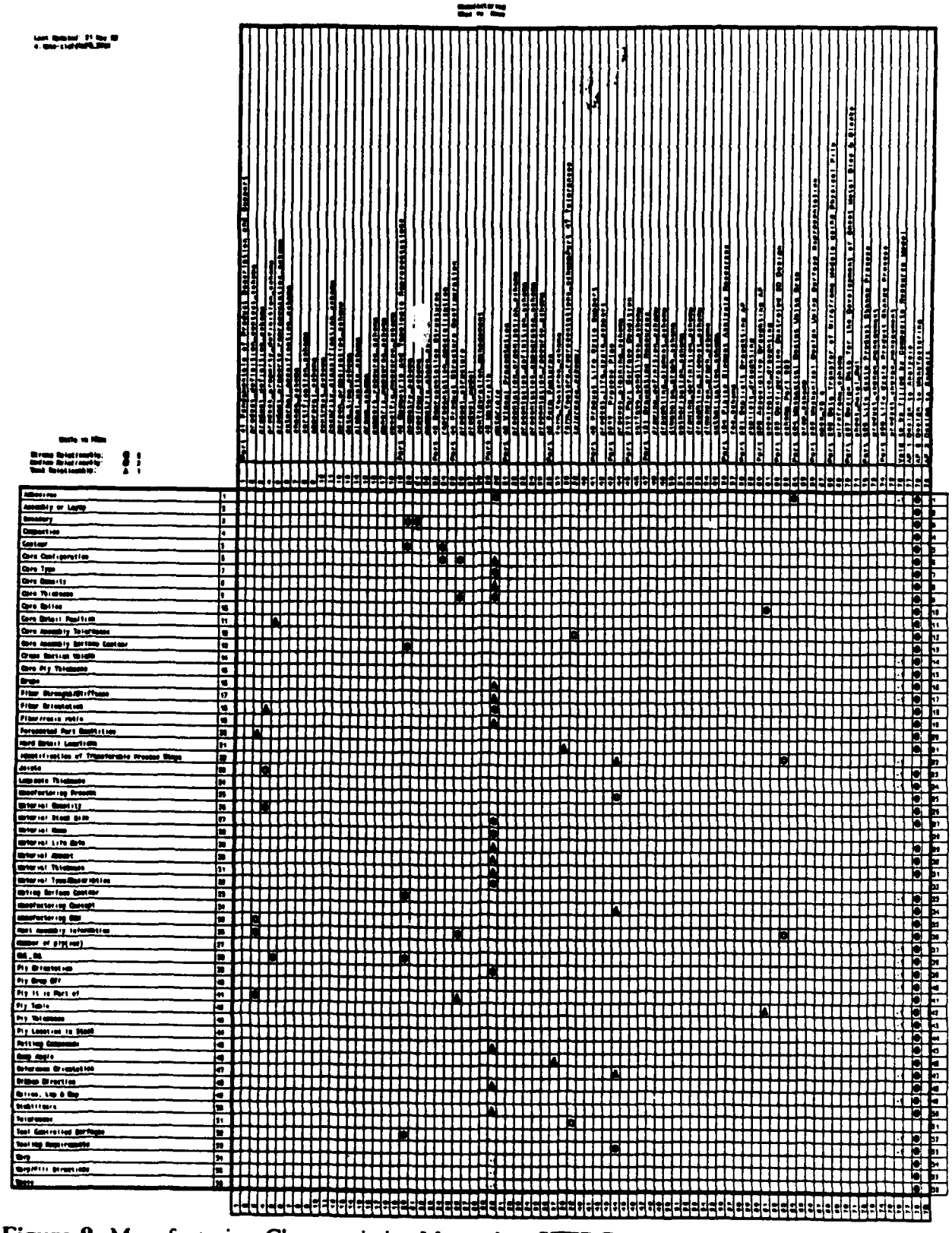

Figure 9 Manufacturing Characteristics Mapped to STEP Resources

4.2 PDES/STEP Identified Voids

The identification of voids within the existing STEP Parts was performed by evaluating the data need defined by the Composite Item Characteristics to the data content of STEP. This comparison process is described in the previous section. The voids identified exist where there is minimal or no support for the Characteristic. These occurrences are identified in the QFD WHAT vs. HOW matrix with a triangle, value of one representing minimal coverage, or a -1 indicating a complete lack of support.

4.2.1 Design

The Design voids are documented in the WHAT versus HOW matrix illustrated in Figure 10. Figure 10 is a shortened version of the matrix presented in Section 4.1.3 that contains only the characteristics that are voids for the sake of clarity.

There are nineteen identified characteristics which require further information definition than what is provided in STEP. These nineteen characteristics can be placed into the following categories; Properties, Manufacturing Process, Shape, Assembly, Tolerance, and Material. It is expected that most of these voids can be filled by the creation or modification of one to five entities each with their corresponding functions, rules, constraints, and documentation.

4.2.2 Analysis

The Analysis voids are documented in the WHAT versus HOW matrix documented in Figure 11. Figure 11 is a shortened version of the matrix presented in Section 4.1.3 that contains only the characteristics that are voids for the sake of clarity.

There are four identified characteristics that require additional PDES/STEP resources. The Analysis Quality/Completeness void was a characteristic that was added to reflect review comments after the work on reference [1] was completed, and there is presently nothing in Part 104 (Finite Element Analysis) that addresses this need. The Test Results void is also not addressed in Part 104. The Analysis Decision Data void is partially addressed, but some enhancement will be required to fulfill PAS-C needs. The Weight void could be addressed either by a Composites model, or by the PDES/STEP Integrated Resources.

It is expected that these voids, and the weak relationships can be addressed by minimal modification to existing PDES/STEP resources.

4.2.3 Manufacturing

The Manufacturing voids are documented in the WHAT versus HOW matrix documented in Figure 12. Figure 12 is a shortened version of the matrix presented in Section 4.1.3 that contains only the characteristics that are voids for the sake of clarity.

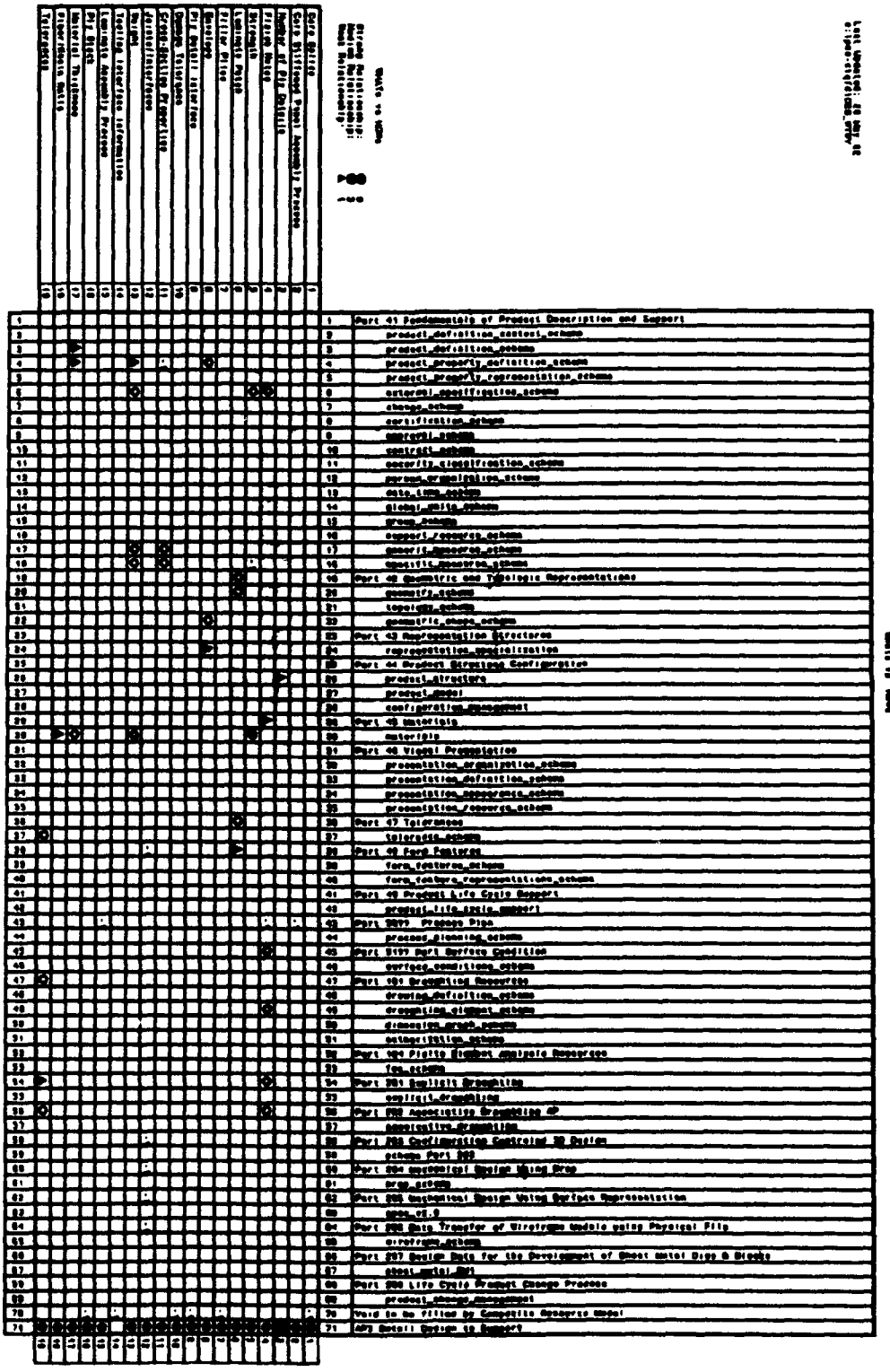

Figure 10 Design Characteristics not Completely Satisfied by STEP.

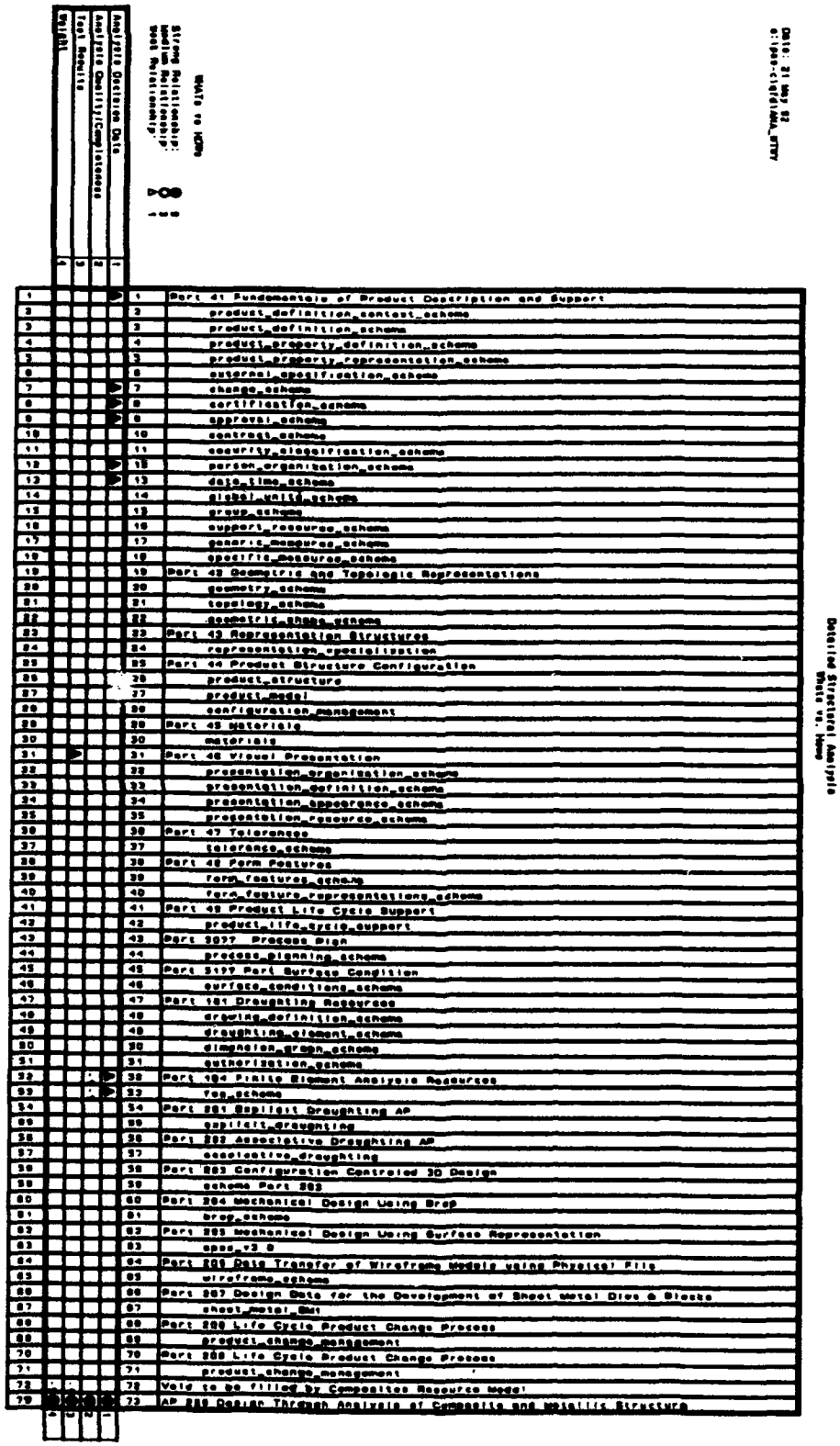

Figure 11 Analysis Voids Prioritized by Importance to the AP

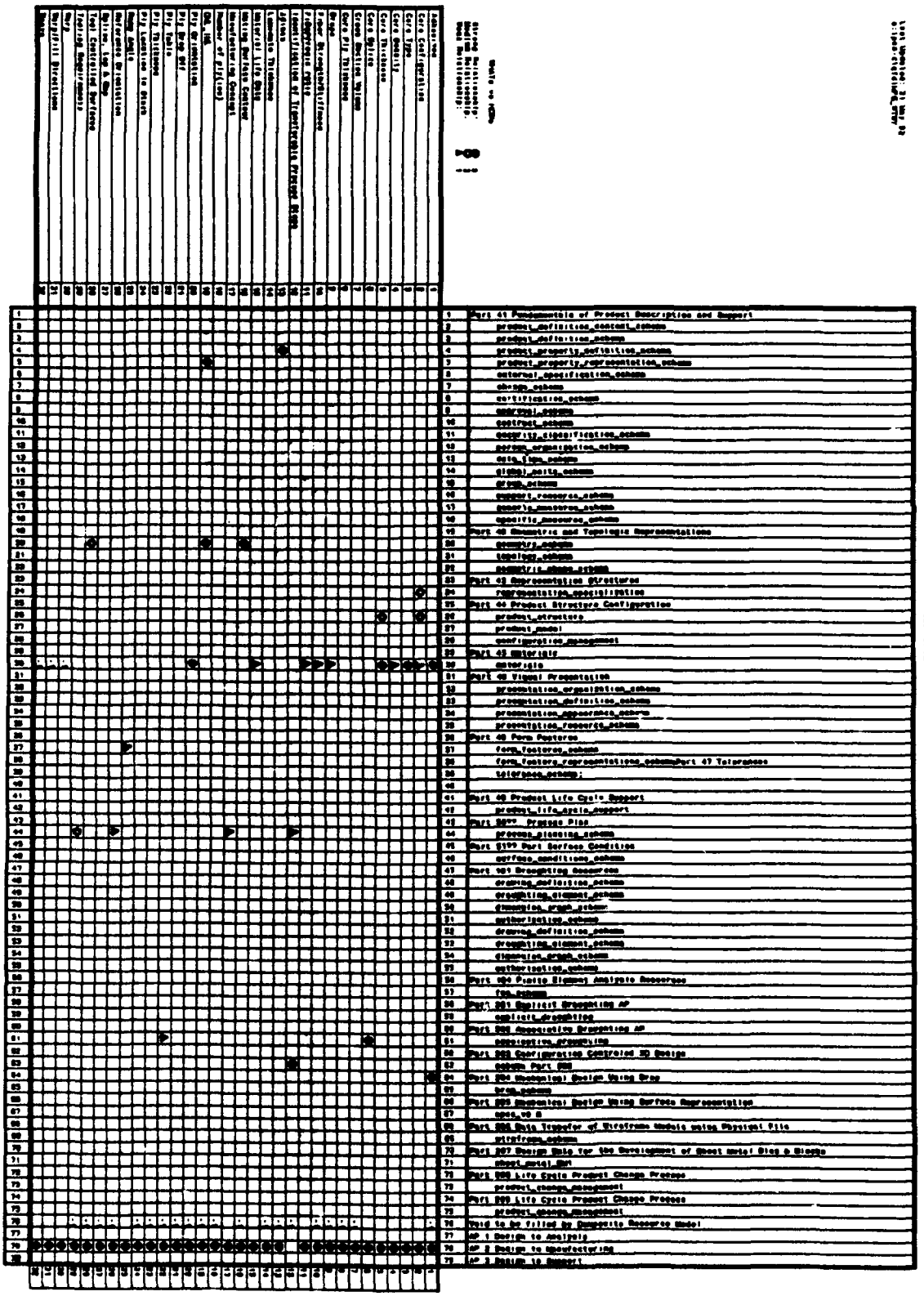

Figure 12 Manufacturing Voids within STEP from a PAS-C View

STEP Part 41 (Fundamentals of Product Description and Support) as it presently exist does not include incorporation of STEP Part 45 (Materials). A planned change for the next STEP release would be this incorporation. Until this occurs, it is difficult to ascertain how these two models will incorporate the unique needs of composite materials. This need is critical since composites represents a unique requirement of viewing the materials both as a finished part and as individual constituents. The Materials Schema as it exists is designed to define composite parts but not necessarily all of the individual constituent materials. Materials which is furnished in higher level processed forms, such as core, is not covered. Material such as weave, cloth, broadgoods, and impregnated materials are represented by description only in the present materials model.

The other major voids could be categorized as in-process part definition required. As a whole, they are definition of composite items in the various stages of production. The overall problem is one that a composite part is an assembly of individual pieces which through the manufacturing process are transformed into an inseparable piece part. The design and manufacturing definition must not only be able to document the end characteristics of a piece part but also must be able to define the individual constituents, many of which, such as a ply piece, do not normally show up in a design or manufacturing bill of materials. These shape problems are compounded by the manufacturing process which normally creates oversize parts which are trimmed to shape, and shapes are determined by lay-up in tooling in predefined locations and orientations. Thus the voids identified to be filled with the composite model were largely the composite items ply and ply piece.

Four voids and ten weak relationships were identified in the first area of materials, particularly in the area of core materials. Twenty voids were identified to be filled by the composite's model, and they are related to information normally obtained in a ply table and or the manufacturing specifications which specify things such as laps and gaps of plies. These voids include the concept of joints which is not covered adequately by existing resources.

5 NEEDS to VOIDS CORRELATION and PRIORITIZATION

5.1 WHAT vs. WHY QFD Analysis

The WHAT (Information Needs) versus WHY (Importance of Needs) matrix of the HoQ was used to record certain quantifiable aspects of the criteria that determine the success of the PAS-C program. The analysis provides a method to prioritize the needs and voids based upon importance to the program success.

Design

The Design WHAT versus WHY table is documented in Figure 13. The priority of addressing the voids is indicated in column 11, "Rank of Wgt'd Importance of Void. The priority of addressing the characteristics within the application protocol is indicated in column 15, "Rank of Wgt'd Importance in AP".

Analysis of these rankings indicates that the voids are spread throughout the spectrum when viewed from their importance to the application protocol. Half of the estimated cost to fill the voids is contained within the top 52% of the characteristics. Seventy percent of the cost to fill the voids is within the top 76% of the characteristics. From a development perspective, this indicates that working the voids should occur based upon the priority of the characteristic within the AP, as shown in Table 1.

Table 1 Design to Analysis Voids

Priority	Design Characteristics
6	Material Thickness
6	Fiber/Resin Ratio
10	Tolerances
12	Tooling Interface Information
16	Envelope
19	Ply Detail Interface
20	Ply Stack
25	Weight
26	Damage Tolerance
29	Laminate Assembly Process
30	Filler Plies
31	Strength
31	Laminate Patch
37	Number of Ply Details
37	Finish Notes
40	Cross-Section Properties
43	Joints/Interfaces
52	Core Splice
55	Core Stiffened Panel Assembly Process

Detailed Structural Design
Whats vs. Whys

Last Updated: 20 May 92
c:\pas-clgrd\DES_WTWY

		Weighting	Percent Utilization	Percent Improvement	Cost to Fill Void	CBA Ratio	Cost to Include into APS	Inverse Normalized Cost	Normalized Utilization	Normalized Improvement	Normalized Cost to Fill Void	Weighted Avg Importance of Void	Rank of Wgt'd Importance of Void	Inverse Normalized Cost	Normalized Cost to Include in AP	Weighted Avg of Importance in AP	Rank of Wgt'd Importance in AP	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
			0.30	0.20	0.50	0.00	0.50	0.50	0.30	0.20	0.50	0.00	0.00	0.50	0.00	0.00	0.00	
Fastener Holes & Cut Outs	1		62.5	0.00			105		20	0		6.01	1	0.27	3.	0.15	1.	1
Mold/Bag Line Surface	2		28.7	0.37			35.		9	3		3.39	3	0.82	1.	3.00	2.	2
Configuration Control Information	3		16.0	1.00			105		5	10		3.50	2	0.27	3.	3.72	3.	3
Material Name	4		11.0	1.00			35.		4	10		3.10	5	0.82	1.	3.59	4.	4
Material Name/Description	5		11.0	1.00			35.		4	10		3.10	6	0.82	1.	3.59	5.	5
Fiber/Resin Ratio	6		10.0	1.00	10	0.0	35.	0.	3	10	2	3.26	4	0.82	1.	3.42	6.	6
Material Thickness	7		10.0	1.00	32	0.0	35.	0.	3	10	4	3.13	7	0.82	1.	3.42	6.	7
Material Stock Size	8		10.0	1.00			35.		3	10		3.01	8	0.82	1.	3.42	6.	8
Ply Stock Size	9		10.0	1.00			35.		3	10		3.01	9	0.82	1.	3.42	6.	9
Tolerances	10		12.5	0.35	32	0.0	70.	0.	4	4	4	2.05	10	0.41	2.	2.13	10	10
Laminate Thickness	11		8.47	0.30			35.		3	4		1.85	12	0.82	1.	2.06	11	11
Tooling Interface Information	12		5.48	0.54	25	0.0	35.	0.	2	6	3	1.70	11	0.82	1.	2.03	12	12
Next Assembly Information	13		12.7	0.00			70.		4	0		1.21	13	0.41	2.	1.42	13	13
OML/IML Surface	14		4.64	0.27			35.		1	3		0.89	14	0.82	1.	1.40	14	14
Panel Size	15		7.59	0.00			35.		2	0		0.72	16	0.82	1.	1.13	15	15
Envelope	16		3.51	0.15	10	0.0	35.	0.	1	2	2	0.81	15	0.82	1.	1.07	16	16
Boundary	17		3.51	0.15			35.		1	2		0.66	18	0.82	1.	1.07	16	17
Percentage (%) Ply Angle/Thickness	18		5.03	0.00			35.		2	0		0.55	24	0.82	1.	0.86	18	18
Ply Detail Interface	19		3.76	0.10	30	0.0	70.	0.	1	2	5	0.84	16	0.41	2.	0.86	18	18
Ply Stack	20		7.77	0.00	30	0.0	70.	0.	2	0	5	0.82	17	0.41	2.	0.84	20	20
Material Specification	21		5.24	0.00			35.		2	0		0.50	27	0.82	1.	0.81	21	21
Flat Pattern	22		1.57	0.15			35.		1	2		0.47	30	0.82	1.	0.80	22	22
Ply Quantities	23		3.84	0.00			35.		1	0		0.30	32	0.82	1.	0.79	23	23
Ply Detail Location	24		1.84	0.10			70.		1	2		0.58	22	0.41	2.	0.78	24	24
Weight	25		3.00	0.00	10	0.0	35.	0.	1	0	2	0.63	20	0.82	1.	0.78	25	25
Damage Tolerance	26		3.00	0.00	25	0.0	35.	0.	1	0	3	0.53	25	0.82	1.	0.78	26	26
Ply Transition	27		3.00	0.00			35.		1	0		0.37	33	0.82	1.	0.76	26	27
Ply Table	28		5.00	0.00			140		2	0		0.56	23	0.20	4.	0.86	28	28
Laminate Assembly Process	29		5.03	0.00	125	0.0	175	0.	2	0	15	0.50	21	0.10	6.	0.83	29	29
Filler Plies	30		3.11	0.00	25	0.0	35.	0.	1	0	3	0.38	34	0.82	1.	0.81	30	30
Laminate Patch	31		1.84	0.00	10	0.0	35.	0.	1	0	2	0.43	28	0.82	1.	0.59	31	31
Strength	32		1.84	0.00	25	0.0	35.	0.	1	0	3	0.34	35	0.82	1.	0.59	31	32
Ply Drop Off	33		1.84	0.00			35.		1	0		0.18	37	0.82	1.	0.58	31	33
Cap Location	34		1.84	0.00			35.		1	0		0.18	37	0.82	1.	0.58	31	34
Ply Detail Identification	35		1.84	0.00			35.		1	0		0.18	37	0.82	1.	0.58	31	35
Length	36		1.84	0.00			35.		1	0		0.18	37	0.82	1.	0.58	31	36
Number of Ply Details	37		1.82	0.00	10	0.0	35.	0.	1	0	2	0.42	30	0.82	1.	0.58	37	37
Finish Notes	38		1.82	0.00	41	0.0	35.	0.	1	0	5	0.27	36	0.82	1.	0.58	37	38
Ply Identification	39		1.82	0.00			35.		1	0		0.17	41	0.82	1.	0.58	37	39
Cross-Section Properties	40		3.00	0.00	25	0.0	105	0.	1	0	3	0.33	25	0.27	3.	0.50	40	40
Angle Location	41		0.25	0.02			35.		0	0		0.07	45	0.82	1.	0.48	41	41
Construction Planes	42		0.32	0.00			35.		0	0		0.05	45	0.82	1.	0.46	42	42
Joints/Interfaces	43		3.01	0.00	125	0.0	175	0.	1	0	15	0.40	31	0.10	6.	0.45	43	43
Adhesive (type)	44		0.25	0.00			35.		0	0		0.02	46	0.82	1.	0.43	44	44
Thickness	45		0.00	0.00			35.		0	0		0.01	47	0.82	1.	0.42	45	45
Core Detail Thickness	46		0.00	0.00			35.		0	0		0.01	48	0.82	1.	0.42	46	46
Core Thickness	47		0.00	0.00			35.		0	0		0.01	48	0.82	1.	0.42	46	47
Core Detail Identification	48		0.01	0.00			35.		0	0		0.00	51	0.82	1.	0.41	48	48
Ramp Angle	49		0.03	0.00			35.		0	0		0.00	52	0.82	1.	0.41	49	49
Core Density	50		0.03	0.00			35.		0	0		0.00	53	0.82	1.	0.41	50	50
Ribbon Direction	51		0.02	0.00			35.		0	0		0.00	54	0.82	1.	0.41	51	51
Core Splice	52		0.01	0.00	23	0.0	35.	0.	0	0	3	0.16	42	0.82	1.	0.41	52	52
Stabilizer	53		0.00	0.00			35.		0	0		0.00	55	0.82	1.	0.41	53	53
Core Holes & Cut Outs	54		0.01	0.00			70.		0	0		0.00	50	0.41	2.	0.20	54	54
Core Stiffened Panel Assembly Process	55		0.42	0.00	125	0.0	175	0	0	0	15	0.07	44	0.10	6.	0.12	55	55
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Figure 13 Design Characteristics are Prioritized by Importance and Cost

Analysis

The Analysis WHAT versus WHY table is documented in Figure 14. As with design, the priority of addressing the voids is indicated in column 11. The priority of working the characteristics into the AP is listed in column 15.

Three of the voids are near the bottom of the importance to the AP ranking. Eighty four percent of the cost of filling the voids is contained within the bottom thirty percent of the characteristics when ranked by importance to the AP. Analysis of the relative rankings of the voids indicates that the voids should be worked as they are encountered according to their importance to the AP, as illustrated in Table 2 .

Table 2 Analysis Voids Prioritized by Importance to the AP

Priority	Analysis Characteristics
5	Weight
32	Analysis Decision Data
32	Analysis Quality/Completeness
46	Test Results

Detailed Structural Analysis
Whats vs. Whys

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		Percent Utilization	Percent Improvement	Cost to Fill Void	CBA Ratio	Cost to Include Into API	Inverse Normalized Cost to	Normalized Utilization	Normalized Improvement	Normalized Cost to Fill Val	Weighted Average Importance	Rank of Weighted Importance	Inverse Normalized Cost to	Normalized Cost to Include	Weighted Average of Imports	Rank of Weighted Importance
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Weighting		0.30	0.20	0.30	0.00	0.50	0.00	0.30	0.20	0.50	0.00	0.55	0.50	0.00	0.00	0.00
Next Assembly Information	1	85.00	7.500			55.0		12	2		4.062	1	0.75	1	4.442	1	1
Configuration Control Data	2	60.00	7.500			35.0		6	2		3.724	2	1.18	1	3.320	2	2
Laminate Thickness(es)	3	31.80	10.35			35.0		4	5		2.154	4	1.18	1	2.750	3	3
Laminate Properties	4	30.40	13.80			45.0		5	4		2.260	3	0.82	1	2.723	4	4
Weight	5	45.00	3.750	55	0.000	35.0	0.06	6	1	10	1.935	6	1.18	1	2.581	5	5
Joints	6	45.00	3.750			45.0		6	1		1.935	6	0.82	1	2.388	6	6
Detailed Structural Analysis	7	33.60	12.30			1000		4	4		1.985	5	0.84	24	2.005	7	7
Assembly List	8	16.80	12.80			35.0		2	4		1.385	15	1.18	1	1.861	8	8
Material Thickness	9	16.80	12.80			35.0		2	4		1.385	15	1.18	1	1.861	8	9
Contoured OML/IML Surface	10	23.40	10.05			45.0		3	3		1.471	8	0.82	1	1.935	10	10
OML/IML Surface	11	23.40	10.05			45.0		3	3		1.471	8	0.82	1	1.935	10	11
Reference Orientation	12	23.40	10.05			45.0		3	3		1.471	8	0.82	1	1.935	10	12
Combined Material Properties	13	23.40	10.05			33.0		3	3		1.471	8	0.75	1	1.850	13	13
Cross-Section Properties	14	23.40	10.05			55.0		3	3		1.471	8	0.75	1	1.850	13	14
Boundary	15	23.40	10.05			82.0		3	3		1.471	8	0.67	1	1.807	15	15
Boundary/Envelope	16	23.40	10.05			82.0		3	3		1.471	8	0.67	1	1.807	15	16
Cell Size	17	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	17
Core Normal	18	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	18
Fiber Volume	19	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	19
Fill Surface	20	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	20
Finish	21	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	21
Material Name/Description	22	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	22
Ply Detail Normal	23	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	23
Ply Sequence Number	24	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	24
Ramp Angle	25	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	25
Resin Content	26	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	26
Ribbon Direction	27	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	27
Warp/Fill Directions	28	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	28
Warp/Fill Percentages	29	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	29
Weave	30	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	30
Adhesive	31	0.400	6.300			35.0		1	2		0.682	17	1.18	1	1.278	17	31
Analysis Decision Data	32	5.800	7.500	85	0.214	35.0	0.09	1	2	10	0.821	43	1.18	1	1.217	32	32
Analysis Quality/Completeness	33	5.800	7.500	55	0.136	35.0	0.06	1	2	10	0.821	43	1.18	1	1.217	32	33
Bottom Surface	34	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	34
Ply It is a part of	35	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	35
Ply Normal	36	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	36
Stack Normal	37	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	37
Top Surface	38	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	38
Warp Surface	39	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	39
Reference Normal	40	0.400	6.300			45.0		1	2		0.682	17	0.82	1	1.146	34	40
Ply Table	41	0.400	6.300			82.0		1	2		0.682	17	0.67	1	1.019	41	41
Laminate Patch	42	0.400	6.300			110.		1	2		0.682	17	0.37	3	0.872	42	42
Mechanical Material Properties	43	0.400	6.300			300.		1	2		0.682	17	0.13	7	0.732	43	43
Shape	44	0.400	6.300					1	2		0.682	17			0.682	44	44
Preliminary Structural Analysis	45	5.800	3.300			800.		1	2		0.506	45	0.05	19	0.532	45	45
Test Results	46	5.800	3.750	300	0.818	300.	0.01	1	1	30	0.406	46	0.13	7	0.475	46	46
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Figure 14 Analysis Characteristics are Prioritized by Importance and Cost

Manufacturing

The Manufacturing WHAT versus WHY table is documented in Figure 15.

Analysis of the relative rankings of the voids indicates that the voids should be worked as they are encountered according to their importance to the AP, as illustrated in, as illustrated in Table 3.

Table 3 Manufacturing Voids Prioritized by Importance to the AP.

Priority	Manufacturing Characteristics
3	Core Type
4	Tool Controlled Surfaces
5	Mating Surface Contour
7	Ramp Angle
8	Core Density
8	Core Thickness
9	Joints
12	Warp/Fill Directions
13	OML_IML
14	Fiber Strength/Stiffness
16	Adhesives
18	Core Configuration
18	Reference Orientation
22	Warp
28	Laminate Thickness
28	Ply Location in Stack
31	Number of Ply(ies)
31	Ply Table
31	Splice, Lap & Gap
37	Cross Section Volume
38	Tooling Requirements
39	Material Life Data
39	Weave
39	Drape
39	Fiber/Resin Ratio
39	Core Splice
39	Manufacturing Concept
48	Core Ply Thickness
48	Ply Thickness
53	Ply Orientation
53	Ply Drop Off
53	Identification of Transferable Process Steps

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Manufacturing Whats vs Whys

		Percent Utilization	Percent Improvement	Cost to Fill Void	CBA Ratio	Cost to Include into AP2	Inverse Normalized Cost to Fill Void	Normalized Utilization	Normalized Improvement	Normalized Cost to Fill Void	Weighted Average Importance of Void	Rank of Weighted Importance of Void	Inverse Normalized Cost of AP	Normalized Cost to Include in AP	Weighted Avg of Importance in AP	Rank of Wgt'd Importance in AP	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Weighting		0.30	0.20	0.50	0.00	0.00	0.50	0.30	0.20	0.50	0.00	0.00	0.50	0.00	0.00	0.00	
Adhesives	1	12.0	0.88	16	0.85	35.0	0.72	2	2	1	1.37	18		1.	1.01	18.00	1
Assembly or Layup	2	7.50				35.0		1			0.40	52		1.	0.40	48.00	2
Boundary	3	24.4	2.38			140.		4	4		2.14	2		4.	2.14	1.000	3
Compaction	4	3.00				35.0		1			0.20	58		1.	0.20	53.00	4
Contour	5	4.50	0.45			35.0		1	1		0.40	48		1.	0.40	38.00	5
Core Configuration	6	15.0	0.45	16	0.02	35.0	0.72	3	1	1	1.37	17		1.	1.00	18.00	6
Core Type	7	19.0	2.02	10	0.20	70.0	1.16	4	4	1	2.30	1		2.	1.79	3.000	7
Core Density	8	16.0	2.02	16	0.12	35.0	0.72	3	4	1	1.86	5		1.	1.58	8.000	8
Core Thickness	9	15.0	2.02	16	0.12	35.0	0.72	3	4	1	1.85	6		1.	1.59	8.000	9
Core Splice	10	4.50	0.45	5	0.00	105.	2.32	1	1	0	1.50	13		3.	0.40	38.00	10
Core Detail Position	11	14.0	0.45			35.0		2	1		0.81	28		1.	0.81	24.00	11
Core Assembly Tolerances	12	12.0	0.45			140.		2	1		0.80	31		4.	0.80	25.00	12
Core Assembly Surface Contour	13	12.0	0.45			35.0		2	1		0.80	31		1.	0.80	25.00	13
Cross Section Volume	14	7.85	0.40	35	0.01	35.0	0.46	1	1	2	0.80	34		1.	0.56	37.00	14
Cure Ply Thickness	15	7.50		35		35.0	0.46	1		2	0.63	41		1.	0.40	48.00	15
Drape	16	4.50	0.45	50	0.00	70.0	0.23	1	1	4	0.52	45		2.	0.40	38.00	16
Fiber Strength/Stiffness	17	8.40	2.02	25	0.08	35.0	0.46	2	4	2	1.42	15		1.	1.10	14.00	17
Fiber Orientation	18	3.95	1.57			35.0		1	3		0.79	36		1.	0.79	28.00	18
Fiber/resin ratio	19	4.50	0.45	10	0.04	70.0	1.16	1	1	1	0.90	27		2.	0.40	38.00	19
Forecasted Part Quantities	20	7.50				70.0		1			0.40	52		2.	0.40	48.00	20
Hard Detail Locations	21	15.0	0.45			105.		3	1		1.00	25		3.	1.00	18.00	21
Identification of Transferable Process Steps	22	3.00		35			0.46	1		2	0.42	47			0.20	53.00	22
Joints	23	15.0	2.02	125	0.01	175.	0.08	3	4	11	1.64	12		5.	1.55	9.000	23
Laminate Thickness	24	3.90	1.57	35	0.06	35.0	0.46	1	3	2	1.02	23		1.	0.79	20.00	24
Manufacturing Process	25	7.50				200.		1			0.40	52		5.	0.40	48.00	25
Material Quantity	26	4.50	0.45			70.0		1	1		0.40	48		2.	0.40	38.00	26
Material Stock Size	27	11.4	1.57			70.0		2	3		1.10	22		2.	1.10	17.00	27
Material Name	28	8.40	2.02					2	4		1.19	20			1.19	14.00	28
Material Life Data	29	4.50	0.45	10	0.04	35.0	1.16	1	1	1	0.90	27		1.	0.40	38.00	29
Material Amount	30	6.90	0.27			35.0		1	0		0.44	46		1.	0.44	38.00	30
Material Thickness	31	8.40	2.02			35.0		2	4		1.19	20		1.	1.19	14.00	31
Material Type/Description	32	19.7	2.02					4	4		1.79	9			1.79	4.000	32
Mating Surface Contour	33	15.0	2.02	25	0.00	35.0	0.46	3	4	2	1.82	8		1.	1.59	8.000	33
Manufacturing Concept	34	4.50	0.45	40	0.01	140.	0.29	1	1	3	0.55	44		4.	0.40	38.00	34
Manufacturing BOM	35	4.50	0.45			105.		1	1		0.40	48		3.	0.40	38.00	35
Next Assembly Information	36	15.0				35.0		3			0.80	33		1.	0.80	27.00	36
Number of ply(ies)	37	8.90	0.45	50	0.00	70.0	0.23	1	1	4	0.72	38		2.	0.60	31.00	37
CML_IML	38	15.2	1.57	50	0.03	70.0	0.23	3	3	4	1.30	14		2.	1.39	13.00	38
Ply Orientation	39	3.00		25		35.0	0.46	1		2	0.43	47		1.	0.20	53.00	39
Ply Drop Off	40	3.00		75		105.	0.15	1		6	0.20	55		3.	0.20	53.00	40
Ply It is Part of	41	7.79	1.57			35.0		1	3		0.99	26		1.	0.99	22.00	41
Ply Table	42	8.90	0.45	25	0.01	70.0	0.46	1	1	2	0.64	38		2.	0.60	31.00	42
Ply Thickness	43	7.50		15		35.0	0.77	1		1	0.70	37		1.	0.40	48.00	43
Ply Location in Stack	44	3.90	1.57	25	0.06	35.0	0.46	1	3	2	1.02	23		1.	0.79	20.00	44
Potting Compounds	45	8.90	0.45			105.		1	1		0.60	42		3.	0.60	31.00	45
Ramp Angle	46	10.7	3.16	90	0.06	70.0	0.23	2	6	4	1.85	7		2.	1.73	7.000	46
Reference Orientation	47	15.0	0.45	25	0.01	35.0	0.46	3	1	2	1.24	18		1.	1.00	18.00	47
Ribbon Direction	48	10.2	3.16			35.0		3	6		2.13	3		1.	2.13	2.000	48
Splice, Lap & Gap	49	8.90	0.45	200	0.00	240.	0.05	1	1	17	0.63	40		7.	0.60	31.00	49
Stabilizers	50	8.90	0.45			35.0		1	1		0.60	42		1.	0.60	31.00	50
Tolerances	51	19.7	2.02					4	4		1.79	9			1.79	4.000	51
Tool Controlled Surfaces	52	19.7	2.02	25	0.00	35.0	0.46	4	4	2	2.03	4		1.	1.79	4.000	52
Tooling Requirements	53	11.2		80		70.0	0.14	2		7	0.67	39		2.	0.60	35.00	53
Warp	54	7.79	1.57	25	0.00	35.0	0.46	1	3	2	1.22	16		1.	0.99	22.00	54
Warp/Fill Directions	55	12.2	2.02	15	0.13	35.0	0.77	2	4	1	1.70	11		1.	1.30	12.00	55
Weave	56	4.50	0.45	15	0.03	35.0	0.77	1	1	1	0.79	35		1.	0.40	38.00	56
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Figure 15 Manufacturing Characteristics are Prioritized by Importance and Cost

5.2 Void Development & Scoping

The strategy for addressing the voids is best described using the symbology within the QFD WHATs vs. HOWs matrix. The voids identified with triangles require modification to existing resource entities. The PAS-C team will work with the IPO/ISO respective committee resources to get these voids filled. Those voids that are identified with a -1 will be addressed by the PAS-C team. Activities will be coordinated with the IPO/ISO regarding all voids to be filled.

Emphasis will be placed on filling all the voids identified. However, due to resource constraints in the PAS-C program and the IPO/ISO, it is possible that the lower priority voids may not be addressed. As stated previously in this section, the voids will be worked in the order of importance to the APs. Those voids that resources are not sufficient to address will not be filled.

6 CONCLUSIONS and RECOMMENDATIONS

The PAS-C program has successfully developed, matured, and applied a methodology to gather and rank the information needs required to produce an Application Protocol Suite for Composites.

The terminology has been refined and reflected in the characteristic and building block names in the tables presented in Appendices B, C, and D. During the creation of these tables a relationship was forged between the information needs (characteristics) and the IDEF0 activity models developed in reference [1].

The Quality Function Deployment House of Quality (HoQ) methodology was used to correlate the information needs to available PDES/STEP resources. The HoQ was also used to identify voids in the STEP Part resources where needs were not met, and to prioritize the needs with respect to both benefits to the PAS-C program and to cost.

All but a few of the voids found during the development of this document were not judged to be serious. It is recommended that the majority of the identified voids be addressed by the PAS-C Application Protocol Suite, with the remainder to be addressed by liaison with the PDES/STEP effort to enhance the PDES/STEP information model resources.

Based upon the comparison of PAS-C needs to PDES/STEP resources, it appears that the IPO/ISO has addressed the more critical areas of information. This analysis has indicated that there are no critical voids within PDES/STEP that would adversely alter PAS-C goals. It is concluded that the risk of relying on PDES/STEP development processes and resources is manageable.

REFERENCES

1. Functional Needs IDEF0 Activity and Information Models for the PAS-C Program, Document No. PASC006.01.00, 9 January, 1992.

2. Scoping and Benefits Criteria (Volume II) for the PAS-C Program, Document No. PASC008.01.00, 14 May, 1992.

3. Functional Needs Report for the PAS-C Program, Document No. PASC002.02.00, 30 September, 1991.

APPENDICES

APPENDIX A - PAS-C Related Documents

Program Master Plan for the PAS-C Program, Document No. PMG001.01.00, 30 August, 1991

Functional Needs Report for the PAS-C Program, Document No. PASC002.01.00, 30 September, 1991

PAS-C Sample Part Set, Document No. PASC003.01.00, 30 September, 1991

1991 Annual Report for the PAS-C Program, Document No. PASC004.01.00, 30 September, 1991

PDES State-of-the-Art (SOTA) Assessment for the PAS-C Program, Document No. PASC005.01.00, 23 December, 1991

Functional Needs IDEF0 Activity and Information Models for the PAS-C Program, Document No. PASC006.01.00, 9 January, 1992

Scoping and Benefits Criteria (Volume I - Executive Summary and Overview) for the PAS-C Program, Document No. PASC007.01.00, 14 May, 1992

Scoping and Benefits Criteria (Volume II) for the PAS-C Program, Document No. PASC008.01.00, 14 May, 1992

Functional Needs/State-of-the-Art Comparison for the PAS-C Program, Document No. PASC009.01.00, 28 May, 1992

Development and Demonstration Plan for the PAS-C Program, Document No. PASC010.01.00, 28 May, 1992

Request for PAS-C documentation should be made to
WL/MTIB, Wright-Patterson AFB, Ohio 45433-6533

APPENDIX B - Design Refined Information Needs

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
DETAIL STRUCTURAL DESIGN (DSD) - FILAMENT ASSEMBLY (FABRIC)		
Material Name/Description	A woven material that primarily includes graphite, fiberglass, aramid fibers with or without different pre-preg matrices (epoxies).	A22323324, A22324
Material Thickness	The cured fabric thickness per ply.	A222212
Fiber Orientation	The greater amount of either the 0° or 90° fiber direction in a weave.	A222212
Fiber/Resin Ratio	The volume percentage of fiber to resin in a fabric.	A22324
Mechanical Material Properties	The basic ply's load carrying properties in a cured state, which is fiber material dependent in both 0° or 90° vector.	A2231
Warp/Fill Directions	See fiber orientation.	A2222121
Warp/Fill Percentages	The ratio of 0° or 90° in the weave.	A2222121
Weave	The different types of braiding in the fabric.	A222212
Material Stock Size	The width and length of the raw fabric	A2222121
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - FILAMENT ASSEMBLY (UNIDIRECTIONAL TAPE)		
Material Name/Description	A unidirectional material that primarily includes graphite, fiberglass, aramid fiber with or without different pre-preg matrices (epoxies).	A22323324, A22324
Material Thickness	The cured unidirectional thickness.	A222212
Fiber/Resin Ratio	The volume percentage of fiber to resin in tape.	A22324

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Mechanical Material Properties	The unidirectional ply's load carrying properties in a cured stated, which is fiber material dependent.	A2231
Material Stock Size	The width of the tape as supplied by the vendor.	A22324, A2222121
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - FILAMENT ASSEMBLY (TOW)		
Material Name/Description	The graphite or fiberglass unidirectional fiber with or without different pre-preg matrices.	A22323324, A22324
Mechanical Material Properties	See Unidirectional.	N/A
Fiber/Resin Ratio	The volume percentage of fiber to resin.	A22324
Material Stock Size	The random size of the fiber arrangement as supplied by the vendor.	A22324
DETAIL STRUCTURAL DESIGN (DSD) - FILAMENT LAMINATE (RADIUS FILLER)		
Filament Laminate Identification	The assigned filament laminate number and description.	A22324
Cross Section	Shape of cross section(s) and area(s).	A223233223133
Length	Length of cross section area(s).	A223233223133
Filament Assembly Constituents	Type and quantity of filament assemblies (ex. Tow) that make up filament laminates.	A22324
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
DETAIL STRUCTURAL DESIGN (DSD) - PLY Piece		
Filament Assembly Characteristics	The tape & fabric characteristics as described in more detail in the Filament Assembly section.	N/A
Boundary	The end of ply piece plan view of either a flat or lofted surface.	A22323222
Flat Pattern	This the end of ply of an unfolded boundary.	A22323222
Fiber Orientation	Direction of the primary load carrying filaments.	A2231
Ply Piece Identification	The assigned ply piece number when ply piece equals one (1) the ply piece identification is the ply number.	A2232332232622
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - PLY		
Ply Piece Characteristics	The ply piece characteristics as described in the prior section.	N/A
Boundary	The end of ply plan view of either a flat or lofted surface.	A22323222
Ply Identification	The assigned ply number.	A22323324
Ply Piece Interface	Where the ply piece (EOP) meet in either a butt, overlap or gap orientation.	A223233221, A22323324
Ply Piece Location	The relative location of the ply piece in relationship to each other in the plan view.	A223233221
Number of Ply Pieces	The number of Ply Pieces in a ply and when the Ply Pieces equals one (1) it is a ply.	A22323324
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
** Material Specification	The data that describes the physical responses of a composite material.	A2232334, A22323322311623 A2232332232623 A22323322331623
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.The number	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - PLY LAMINATE (GENERAL FLAT)		
Envelope	The envelope of the part in the XYZ planes.	A22323222
Laminate Thickness	The dimension of the ply set-up.	A22323323
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	A2232331
Fastener Holes & Cut Outs	The removed portions of the laminate part.	A223233223312
Ply Characteristics	The ply characteristics as described in the prior section.	N/A
Ply Stack	A subset of ply table consisting of sequence and location.	A223233223261
Ply Table	A matrix of the ply laminate characteristics.	A223233223262
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Ply Transition	The drop off of plies in the laminate.	A223233223263
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342
Strength	The capacity to carry loads.	A2231, A2234
Weight	The density characteristic times the volume of the part.	A2231
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	A22323322312
Laminate Properties	The combined mechanical properties of the laminate.	A2231

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Laminate Patch	A constant thickness area of a ply laminate.	A22323322324
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	A2222113
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	A22323322312
Filler Plies	Plies added to meet the design tolerances.	A223233335
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	A22322, A2232333, A226
** Finish Notes	Engineering notes specifying end-item finish requirements.	A22323324
** Ply Stock Size	Engineering specified stock size estimate.	A22324
** Ply Quantities	The number of plys within a laminate based on the target thickness and orientations.	A223233223115, A22323322325, A223233223315
** Material Specifications	The data that describes the physical responses of a composite material.	A2232334, A22323322311623 A2232332232623 A22323322331623
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc..	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - PLY LAMINATE - (GENERAL CONTOURED WRAPPABLE - CONTOURED SKIN LAMINATE (CSL))		
Envelope	The envelope of the part in the XYZ planes.	A22323222
Laminate Thickness	The dimension of the ply set-up.	A22323322324
Contoured Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	A2232331
Fastener Holes & Cut Outs	The removed portions of the laminate part.	A22323

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Ply Characteristics	The ply characteristics as described in the prior section.	N/A
Ply Stack	A subset of ply table consisting of sequence and location.	A223233223261
Ply Table	A matrix of the ply laminate characteristics.	A223233223262
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Ply Transition	The drop off of plies in the laminate.	A223233223263
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342
Strength	The capacity to carry loads.	A2231, A2234
Weight	The density characteristic times the volume of the past.	A2233, A2232332232623
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	A22323322324
Laminate Patch	A constant thickness area of a ply laminate.	A22323322324
Laminate Properties	The combined mechanical properties of the laminate.	A2231
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	A2222113
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	A223233223261
Filler Plies	Plies added to meet the design tolerances.	A223233335
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	A22322, A2232333, A226
** Finish Notes	Engineering notes specifying end-item finish requirements.	A22323324
** Ply Quantities	The number of plys within a laminate based on the target thickness and orientation.	A223233223115, A22323323325, A223233223315

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
** Material Specifications	The data that describes the physical responses of a composite material.	A2232334 A22323322311623 A2232332232623 A22323322331623
** Ply Stock Size	Engineering specified stock size estimate.	A22324
* Tooling Interface Information	The Inner Mold Line (IML) and Outer Mold Line (OML) of the ACSP.	A2232331
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - PLY LAMINATE (ANGLE)		
Envelope	The envelope of the part in the XYZ planes.	A22323222, A223233223112
Laminate Thickness	The dimension of the ply set-up.	A223233223114
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	A223233
Fastener Holes & Cut Outs	The removed portions of the laminate part.	A2232332231
Ply Characteristics	The ply characteristics as described in the prior section.	N/A
Ply Stack	Ply stack is a subset of ply table consisting of sequence and location.	A223233223113, A2232332231161
Ply Table	A matrix of the laminate characteristics.	A2232332231162
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Ply Transition	The drop off of plies in the laminate.	A2232332231163
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342, A22323322311623
Strength	The capacity to carry loads.	A2234, A2231, A22323322311623

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Weight	The density characteristic times the volume of the past.	A2233, A22323322311623
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	A223233223114
Laminate Patch	A constant thickness area of a ply laminate.	A22323322324
Laminate Properties	The combined mechanical properties of the laminate.	A2231
Cross-Section Properties	The mechanical properties of the cross-sectional area.	A22323322311623
Angle Location	The Angle location relative to the position in the assembly.	A223233331
Laminate Symmetry	The balancing of the ply orientations with respect to the neutral axis.	A222113
Laminate Assembly Process	The sequence of assembling the laminate in the shop.	A2232332231161
Filler Plies	Plies added to meet the design tolerances.	A223233335, A223233223132
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	A22322, A2232333, A226
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Finish Notes	Engineering notes specifying end-item finish requirements.	A22323324
** Ply Quantities	The number of plys within a laminate based on the target thickness and orientations.	A223233223115, A22323322325, A223233223315
** Material Specifications	The data that describes the physical responses of a composite material.	A2232334 A22323322311623 A2232332232623 A22323322331623
** Ply Stock Size	Engineering specified stock size estimate.	A22324

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - PLY LAMINATE (CAP)		
Boundary	The outline of a ply laminate plan view of either a flat or lofted surface.	A22323322312
Laminate Thickness	The dimension of the ply set-up.	A22323322312
OML/IML Surface	The outer mold line and either mold line surface of the cap.	A22323322312
Joints/Interfaces	The removed portions of the laminate part.	A22323322312
Ply Stack	Ply stack is a subset of ply table consisting of sequence and location.	A22323322312
Ply Table	A matrix of the laminate characteristics.	A22323322312
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323322312
Ply Drop Off	The drop off of plies in the laminate.	A22323322312
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22323322312
Strength	The capacity to carry loads.	A2234, A2231
Laminate Patch	A constant thickness area of a ply laminate.	A22323322324
Weight	The density characteristic times the volume of the past.	A2233
Percentage (%) Ply Angle/Thickness	The percentage of ply orientations in a given thickness per material type per material type.	A22323322312
Laminate Properties	The combined mechanical properties of the laminate.	A2231
Cross-Section Properties	The mechanical properties of the cross-sectional area.	A22323322312
Cap Location	The Cap location relative to the position in the assembly.	A22323322312

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Next Assembly Information	The necessary characteristics of adjoining parts. Reference information only.	A22322, A2232333, A226
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Finish Notes	Engineering notes specifying end-item finish requirements.	A22323324
** Ply Quantities	The number of plys within a laminate based on the target thickness and orientations.	A223233223115, A22323322325, A223233223315
** Material Specifications	The data that describes the physical responses of a composite material.	A2232334 A22323322311623 A2232332232623 A22323322331623
** Ply Stock Size	Engineering specified stock size estimate.	A22324
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc..	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - CORE (MATERIAL STOCK)		
Material Name	A ribbon or foam oriented material that primarily includes fiberglass, phenolic and metals. (Material Supplier/Material Type)	A2232332233233
Material Thickness	This is thickness parallel to the cell direction as supplied by the vendor.	A22324
Ribbon Direction	The direction of continuous ribbon.	A223233223325
Core Density	The weight per unit volume.	A2232332233232
Mechanical Material Properties	The load carrying properties.	A2231
Material Stock Size	The thickness, width and length of the core as supplied by the vendor.	A22324
Core Stock Characteristics	The characteristics of the core as described in more detail in the previous section.	N/A
Envelope	The envelope of the part in the XYZ planes.	A22323222

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Flat Pattern	The edge of core of an unfolded envelope.	A22323222
Core Detail Identification	When core detail equals one (1) then the ply detail identification is the ply number.	A22323322331622
Ramp Angle	The chamfered angle of the core edge.	A223233223324
Core Detail Thickness	The height of the core at any given location.	A2232332233231
Core Detail Characteristics	The characteristics as described in more detail in the previous section.	N/A
** Material Specifications	The data that describes the physical responses of a composite material.	A2232334 A22323322311623 A2232332232623 A22323322331623
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - CORE (PROCESSED - MACHINED)		
Core (Material - Stock) Characteristics	The characteristics as described in detail structural design core/material - stock) after being machined.	N/A
Envelope	The envelope of the core in the XYZ planes.	A22323222
Ramp Angle	The chamfered angle of the core edge.	A223233223324
Core Splice	The core detail interface.	A2232332233221
Core Thickness	The height of the core at any given location.	A2232332233231
Core Holes & Cut Outs	The removed portions of the core.	A2232332233222
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Combined Mechanical Material Properties	The combined load carrying properties.	A2231
Make From Core Identifier	The type of core (material or processed) which this core (processed - machined) is made from and its configuration control identifier.	A22324
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
** Tooling Interface Information	The Inner Mold Line (IML) and Outer Mold Line (OML) of the ACSP.	A2232331
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - CORE (PROCESSED - FORMED)		
Boundary/Envelope	The boundary/envelope of the part in the XYZ planes.	A22323222
Ramp Angle	The chamfered angle of the core edge.	A223233223324
Core Splice	The core detail interface.	A2232332233221
Core Density	The weight per unit volume.	A2232332233232
Core Thickness	The height of the core at any given location.	A2232332233231
Joints/Interfaces	The removed portions of the laminate part.	A2232332233163
Ribbon Direction	The direction of continuous ribbon.	A223233223325
Material Name	A ribbon or foam oriented material that primarily includes gloss phenolic and metals.	A2232332233233
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Panel Size	The length and width of the panel within the next assembly.	A223233334
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Mechanical Material Properties	The combined load carrying properties.	A2231
OML/IML Surface	The laminate surface in contact with mold or bag.	A2232331
Make From Core Identifier	The type of core (material or processed) which this core (processed - formed) is made from and its configuration control identifier.	A22324
* Construction Planes	The construction plane(s) that render the desired views of an ACSP.	A22323221
* Tooling Interface Information	The Inner Mold Line (IML) and Outer Mold Line (OML) of the ACSP.	A2232331
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - CORE (PROCESSED - STABILIZED)		
Boundary/Envelope	The boundary/envelope of the part in the XYZ planes.	A2232322
Ramp Angle	The chamfered angle of the core edge.	A223233223324
Core Splice	The core detail interface.	A2232332233221
Core Density	The weight per unit volume.	A2232332233232
Core Thickness	The height of the core at any given location.	A2232332233231
Joints/Interfaces	The removed portions of the laminate part.	A2232332233163
Ribbon Direction	The direction of continuous ribbon.	A223233223325
Material Name	A ribbon or foam oriented material that primarily includes fiberglass, phenolic and metals.	A2232332233233
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A2232333
Panel Size	The length and width of panel within the next assembly.	A223233334

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342
Mechanical Material Properties	The combined load carrying properties.	A2231
Make From Core Identifier	The type of core (material or processed) which this core (processed - stabilized) is made from and its configuration control identifier.	A22324
Stabilizer	An injected material to and in support of the core ribbon.	A2232332233223
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	The characteristics as described in more detail in the core section.	N/A
Ply Laminate Characteristics	These are characteristics as described in more detail in the ply laminate section.	N/A
Adhesive (type)	A bonding agent between the core and the laminate. Note: This includes an X-ply for smoothing.	A223233332
Fastener Holes & Cut Outs	The removed portions of the core.	A2232332233222, A223233334
Ply Table	A matrix of the Assembly characteristics.	A2232332233162
Envelope	The envelope of the part in the XYZ planes.	A22323222
Thickness	The combined sandwich thickness.	A223233223314, A2232332233231
Mold/Bag Line Surface	The laminate surface in contact with mold or bag.	A2232331
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Panel Size	The length and width of panel within the next assembly.	A223233334
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342
Strength	The capacity to carry loads.	A2234, A2231
Weight	The density characteristic times the volume of the past.	A2233, A223233223323
Core Stiffened Panel Assembly Process	The sequence of assembling the laminate and the core in the core assembly.	A223233332, A223233335
Filler Characteristics	These are characteristics as described in more detail in the filament assembly (radius filler) section.	N/A
Assembly Symmetry	The balancing of the ply orientations with respect to the neutral axis.	A2222113
Next Assembly Information	These are necessary characteristics of adjoining parts. Reference information only.	A22322, A2232333, A226
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226
DETAIL STRUCTURAL DESIGN (DSD) - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE)/PLY LAMINATE (ANGLE)/FILAMENT LAMINATE (RADIUS FILLER)/PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate Angle) Characteristics	These are characteristics as described in more detail in the Angle section.	N/A
Filament Laminate (Radius Filler) Characteristics	These are characteristics as described in more detail in the Filler section.	N/A
Ply Laminate (Cap) Characteristics	These are characteristics as described in more detail in the Cap section.	N/A
Joints/Interfaces	The removed portions of the laminate part.	A2232332233163

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Panel Size	The length and width of panel within the next assembly.	A223233314
Tolerances	The dimensional tolerances of the part due to conventional design/build constraints.	A22323323
Damage Tolerance	The ability to resist damage in the normal operating environment in its life cycle.	A22342
Strength	The capacity to carry loads.	A2234, A2231
Weight	The density characteristic times the volume of the past.	A2222113, A2233
* Tooling Interface Information	The Inner Mold Line (IML) and Outer Mold Line (OML) of the ACSP.	A2232331
** Configuration Control Information	Effectivities, Contract Number, Drawing ID, Drawing Title, Part Number, etc.	A22322, A22324, A226

* Additions required by activities
** Additions required by AP scope

APPENDIX C - Analysis Refined Information Needs

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
DETAIL STRUCTURAL ANALYSIS - FILAMENT ASSEMBLY (FABRIC)		
Material Name/Description	The name of the material system and a description including the following: warp and fill fibers, resin, manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic, applicable specifications.	A223352133
Material Thickness	Nominal theoretical thickness of the Filament Assembly (Fabric) when cured in a laminate that corresponds to fiber volume and resin content.	A223352131 A223352132
Reference Orientation	The basic orientation direction of the fabric relative to an established coordinate system.	A223352132
Warp/Fill Directions	The warp and fill directions with respect to the reference orientation. The warp direction is established by the fibers that are oriented longitudinally in the fabric, fill are the fibers that cross the warp fibers.	A223352133
Warp/Fill Percentages	The percentage of fiber in the warp and fill directions. The percentages are assumed to add to 100%.	A223352133
Fiber Volume	Percentage of the total laminate volume composed of fibers.	A223352133
Resin Content	Percentage of the total material weight composed of resin.	A223352133

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Mechanical Material Properties	The mechanical properties of the Filament Assembly (Fabric) including: Density Warp Youngs Modulus - Compression Fill Youngs Modulus - Compression Warp Youngs Modulus - Tension Fill Youngs Modulus - Tension Through the Thickness Youngs Modulus (33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Warp Thermal Coefficient Fill Thermal Coefficient Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12,23, 13) Warp Moisture Absorption Coefficient Fill Moisture Absorption Coefficient Through the Thickness Moisture Absorption Coefficient (33) Strain Allowables Warp Compressive Fill Compressive Through the Thickness Compressive (33) Warp Tensile Fill Tensile Through the Thickness Tensile (33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Warp Compressive Fill Compressive Through the Thickness Compressive (33) Warp Tensile Fill Tensile Through the Thickness Tensile (33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	A223352133

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Weave	Style of weaving used to form the fabric. Some examples include: five harness stain, crows foot, twill.	A223352133
Finish	The sizing put on the tows prior to weaving and resin impregnation.	A223352133
DETAIL STRUCTURAL ANALYSIS - FILAMENT ASSEMBLY (TAPE)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic, applicable specifications.	A223352133
Material Thickness	Nominal theoretical thickness of the Filament Assembly (Tape) when cured in a laminate that corresponds to fiber volume and resin content.	A223352131
Fiber Volume	Percentage of the total laminate volume composed of fibers.	A223352133
Resin Content	Percentage of the total material weight composed of resin.	A223352133

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Mechanical Material Properties	The mechanical properties of the Filament Assembly including: Density Youngs Modulus - Compression (11, 22, 33) Youngs Modulus - Tension (11, 22, 33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Thermal Coefficient (11, 22) Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12, 23, 13) Moisture Absorption Coefficient (11, 22) Strain Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	A223352133
DETAIL STRUCTURAL ANALYSIS - FILAMENT LAMINATE (TOW)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin manufacturer(s), tow size, toughened/untoughened, thermoset/thermoplastic, grade and type callouts for adhesive (if present), applicable specifications. Material Thickness	A223352133
Fiber Volume	Percentage of the total laminate volume composed of fibers.	A223352133

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Resin Content	Percentage of the total material weight composed of resin.	A223352133
Mechanical Material Properties	The mechanical properties of the Filament Assembly (Filler) including: Density Youngs Modulus - Compression (11, 22, 33) Youngs Modulus - Tension (11, 22, 33) Poisson's Ratio (12, 23, 13) Shear Modulus (12, 23, 13) Thermal Coefficient (11, 22) Through the Thickness Thermal Coefficient (33) Shear Thermal Coefficient (12, 23, 13) Moisture Absorption Coefficient (11, 22) Strain Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Positive Shear (12, 23, 13) Negative Shear (12, 23, 13) Stress Allowables Compressive (11, 22, 33) Tensile (11, 22, 33) Shear (12, 23, 13) Characteristic Dimension for Tension (Fastener Analysis) Characteristic Dimension for Compression (Fastener Analysis) Miscellaneous Properties	A223352133
Shape	The cross-sectional geometry of the filler if it is preformed.	A223352133
DETAIL STRUCTURAL ANALYSIS - FILAMENT LAMINATE (RADIUS FILLER)		
Filament Laminate Identification	The assigned filament laminate number and descriptor.	
Cross Section	The shape of the filament laminate cross-section(s) and area(s).	

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Length	The length of the filament laminate cross-section area(s).	
Filament Assembly Constituents	Type and quantity of filament assemblies (ex:tow) that make up the filament laminate.	
DETAIL STRUCTURAL ANALYSIS - PLY PIECE		
Boundary	The location of the outer contiguous perimeter of a Ply Piece.	A223352132
Reference Orientation	The basic orientation direction of the Ply Piece relative to an established coordinate system.	A223352132
Ply it is a part of	Reference to the ply that the Ply Piece is a part of.	A223352132
Filament Assembly Characteristics	A reference to a Filament Assembly, including all the characteristics of that Filament Assembly.	N/A
OML/IML Surface	The surfaces that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the Ply Piece.	A223352132
Ply Piece Normal	A normal to the OML or IML surface of the Ply Piece positive in the direction of ascending Ply Sequence Number.	A223352132
Warp Surface	The side of the woven fabric where the material is composed of yarns running lengthwise to the fabric.	A223352133
Fill Surface	The side of the woven fabric where the majority of the visible weave is composed of yarns running in the width of the fabric.	A223352133
DETAIL STRUCTURAL ANALYSIS - PLY		
Boundary	The location of the outer contiguous perimeter of a Ply.	A223352132

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Reference Orientation	The basic orientation direction of the Ply relative to an established coordinate system.	A223352132
Ply Piece Characteristics	A reference to a list of Ply Piece(s) including all the characteristics of the member Ply Piece(s).	N/A
Ply Sequence Number	The Ply Sequence Number is the order in which the Plies are laid down on the tool. The first Ply laid down is ply number 1, and the remaining Plies are assigned sequence numbers in ascending order.	A223352132
OML/IML Surface	The surfaces that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the Ply.	A223352132
Ply Normal	A normal to the OML or IML surface of the Ply Piece positive in the direction of ascending Ply Sequence Number.	A223352132
DETAIL STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL FLAT)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	A223352132
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A223352131 A223352132
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	A223352132
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	A223352132
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a General Flat Ply Laminate.	A22335 A22336
Weight	The weight of the General Flat Ply Laminate.	A22334

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	A223352133
Stack Normal	A normal to the OML or IML surface of the General Flat Ply Laminate, positive on the direction of ascending Ply Sequence Number.	A223352132
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
DETAIL STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL CONTOUR/WRAPPABLE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	A223352132

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A223352131 A223352132
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	A223352132
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	A223352132
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a General Contour/Wrappable Ply Laminate.	A22335 A22336
Weight	The weight of the General Contour/Wrappable Ply Laminate.	A22334
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223352 A22322 A2232333 A226
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	A223352133
Stack Normal	A normal to the OML or IML surface of the General Contour/Wrappable Ply Laminate, positive on the direction of ascending Ply Sequence Number.	A223352132
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
DETAIL STRUCTURAL ANALYSIS - PLY LAMINATE (ANGLE AND CAP)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	A223352132
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A223352131 A223352132
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of an Angle/Cap Ply Laminate.	A223352132
Ply Table	A list of references of the constituent Plies and all their characteristics and associated Ply Sequence Numbers.	A223352132
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of an Angle Ply Laminate.	A22335 A22336
Weight	The weight of the General Contour/Wrappable Ply Laminate.	A22334
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Cross Section Properties	The beam bending properties of the Angle cross section (moments of inertia, etc.)	A223352131
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of an Angle/Cap Ply Laminate.	A223352133
Reference Orientation	The basic orientation direction of the Angle/Cap Ply Laminate relative to an established coordinate system.	A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
DETAIL STRUCTURAL ANALYSIS - CORE (MATERIAL AND PROCESSED - MACHINED)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), toughened/untoughened, thermoset/thermoplastic/metal, applicable specifications.	A223352133
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core.	A223352132
Ramp Angle	The angle of the boundary envelope surface where it intersects the Core Top or Bottom Surface.	A223352132 ?

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226
Ribbon Direction	The continuous Ribbon Direction of the Core.	A223352132
Cell Size	The size of the honeycomb cells of the Core.	A223352133
Weight	The weight of the Core.	A223353
Material Properties	The mechanical Material Properties of the Core.	A223352133
Core Normal	A direction normal to the Top Surface of the Core positive from the Bottom Surface to the Top Surface.	A223352132
Top Surface	The surface that the Core Normal is defined with respect to.	A223352132
Bottom Surface.	The surface located on the negative core normal direction from the top surface.	A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
DETAIL STRUCTURAL ANALYSIS - CORE (PROCESSED - ASSEMBLY)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core Assembly.	A223352132
Core (Material & Processed) Characteristics	A reference to a list of Core including all the characteristics of the member Core.	N/A

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226
Reference Orientation	The basic orientation direction of the Core Assembly relative to an established coordinate system.	A223352132
Assembly List	A list specifying the assembly of the constituent Core. Constituent Core coordinate systems are assembled with respect to the Reference Orientation.	A223352131 A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
DETAIL STRUCTURAL ANALYSIS - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	A reference to a Core including all the characteristics of the Core.	N/A
Ply Laminates Characteristics	A reference to two Ply Laminates (also known as face sheets) including all the characteristics of the Ply Laminates.	N/A
Adhesive (type)	The adhesive used to bond the face sheets to the Core Assembly.	A223352133
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A223352132
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	A223352132
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a Composite Assembly.	A22335 A22336
Weight	The weight of the Composite Assembly.	A22334
Combined Material Properties	The smeared (equivalent) mechanical Material Properties of the Composite Assembly.	A223352133
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A223352132
Reference Normal	A direction normal to the top surface of the Core Assembly bond mold surface positive in the part direction from the surface.	A223352132
Assembly List	A list specifying the assembly of the face sheets and Core Assembly. Core Detail and face sheet coordinate systems are assembled with respect to the Core Assembly Reference Orientation.	A223352131 A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
DETAIL STRUCTURAL ANALYSIS - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT LAMINATE (RADIUS FILLER)/ PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate (Angle) Characteristics	A reference to two Ply Laminates (Angle) including all the characteristics of the Ply Laminates.	N/A
Filament Laminate (Radius Filler) Characteristics	A reference to a Filament Laminate (Radius Filler) including all the characteristics of the Filament Laminate Detail.	N/A
Ply Laminate (Cap) Characteristics	A reference to a Ply Laminate (Cap) including all the characteristics of the Ply Laminate.	N/A
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A223353 A223233223 A223233163
Next Assembly Information	References to the attachment of the part to adjoining parts.	A223353 A22322 A2232333 A226
Cross Section Properties	The beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	A223352131
Detail Structural Analysis	The static stress analysis and durability/damage tolerance analysis of a Composite Assembly.	A22335 A22336
Weight	The weight of the Composite Assembly.	A22334
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A223352132
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A223352132

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Assembly List	A list specifying the assembly of the two angles, filler and cap into a Composite assemble Assembly. Angle, filler and cap coordinate systems are assembled with respect to the Reference Orientation.	A223352131 A223352132
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
PRELIMINARY STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL FLAT)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	A2222132 A2222142
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A2222132 A2222142
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	A2222132 A2222142
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	A2222132 A2222142
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	A2222
Weight	The weight of the General Flat Ply Laminate.	A2222132 A2222142
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	?
Next Assembly Information	References to the attachment of the part to adjoining parts.	?
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	A22221
Stack Normal	A normal to the OML or IML surface of the General Flat Ply Laminate, positive on the direction of ascending Ply Sequence Number.	A2222132 A2222142
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	A2222132 A2222142
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
PRELIMINARY STRUCTURAL ANALYSIS - PLY LAMINATE (GENERAL CONTOUR/WRAPPABLE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A2222132 A2222142
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	A2222132 A2222142
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	A2222132 A2222142
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	A2222132 A2222142
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	A2222
Weight	The weight of the General Contour/Wrappable Ply Laminate.	A2222132 A2222142
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	?
Next Assembly Information	References to the attachment of the part to adjoining parts.	?
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	A22221
Stack Normal	A normal to the OML or IML surface of the General Contour/Wrappable Ply Laminate, positive on the direction of ascending Ply Sequence Number.	A2222132 A2222142
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
PRELIMINARY STRUCTURAL ANALYSIS - PLY LAMINATE (ANGLE AND CAP)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of an Angle/Cap Ply Laminate.	A2222132 A2222142
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A2222132 A2222142
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of an Angle/Cap Ply Laminate.	A2222132 A2222142
Ply Orientations	A list of ply orientations defined with respect to the reference orientation. Note that this information is combined with the Ply Percentages to provide a complete laminate description.	A2222132 A2222142
Ply Percentages	The percentage of total theoretical laminate thickness in each ply orientation.	A2222132 A2222142
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	A2222
Weight	The weight of the General Contour/Wrappable Ply Laminate.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	?
Next Assembly Information	References to the attachment of the part to adjoining parts.	?
Cross Section Properties	The beam bending properties of the Angle cross section (moments of inertia, etc.)	A2222132 A2222142
Laminate Properties	The mechanical Laminate Properties of the various Laminate Thicknesses of an Angle/Cap Ply Laminate.	A22221
Reference Orientation	The basic orientation direction of the Angle/Cap Ply Laminate relative to an established coordinate system.	A2222132 A2222142
**Analysis Quality/Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
PRELIMINARY STRUCTURAL ANALYSIS - CORE (MATERIAL & PROCESSED - MACHINED)		
Material Name/Description	The name of the material system and a description including the following: fibers, resin, manufacturer(s), toughened/untoughened, thermoset/thermoplastic/metal, applicable specifications.	A22221
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter surface of a Core.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load. May or may not require Next Assembly information.	A2222132 A2222142
Ribbon Direction	The continuous Ribbon Direction of the Core.	A2222132 A2222142
Weight	The weight of the Core.	A2222132 A2222142
Material Properties	The mechanical Material Properties of the Core.	A22221
Core Normal	A direction normal to the Top Surface of the Core positive from the Bottom Surface to the Top Surface.	A2222132 A2222142
Top Surface	The surface that the Core Normal is defined with respect to.	A2222132 A2222142
Bottom Surface.	The surface located on the negative core normal direction from the top surface.	A2222132 A2222142
PRELIMINARY STRUCTURAL ANALYSIS - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	A reference to a Core including all the characteristics of the Core.	N/A
Ply Laminates Characteristics	A reference to two Ply Laminates (also known as face sheets) including all the characteristics of the Ply Laminates.	A2222132 A2222142
Adhesive (type)	The adhesive used to bond the face sheets to the Core.	A2222132 A2222142
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	?
Next Assembly Information	References to the attachment of the part to adjoining parts.	?

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A2222132 A2222142
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	A2222132 A2222142
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	A2222
Weight	The weight of the Composite Assembly.	A2222132 A2222142
Combined Material Properties	The smeared (equivalent) mechanical Material Properties of the Composite Assembly.	A22221
Assembly Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A2222132 A2222142
Reference Normal	A direction normal to the top surface of the Core Assembly bond mold surface positive in the part direction from the surface.	A2222132 A2222142
Assembly List	A list specifying the assembly of the face sheets and Core Assembly. Core Detail and face sheet coordinate systems are assembled with respect to the Assembly Reference Orientation.	A2222132 A2222142
**Analysis Quality/ Completeness	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
PRELIMINARY STRUCTURAL ANALYSIS - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT LAMINATE (RADIUS FILLER)/ PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate (Angle) Characteristics	A reference to two Ply Laminates (Angle) including all the characteristics of the Ply Laminates.	N/A
Filament Laminate (Radius Filler) Characteristics	A reference to a Filament Laminate (Radius Filler) including all the characteristics of the Filament Laminate.	N/A
Ply Laminate (Cap) Characteristics	A reference to a Ply Laminate (Cap) including all the characteristics of the Ply Laminate.	N/A
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	?
Next Assembly Information	References to the attachment of the part to adjoining parts.	?
Cross Section Properties	The beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	A2222132 A2222142
Preliminary Structural Analysis	Analytical trade studies to define and optimize structural configurations producing preliminary thicknesses, ply orientations and stiffener/core cross section/geometry/spacing.	A2222
Weight	The weight of the Composite Assembly.	A2222132 A2222142
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A2222132 A2222142
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A2222132 A2222142

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Assembly List	A list specifying the assembly of the two angles, filler and cap into a Composite assemble Assembly. Angle, filler and cap coordinate systems are assembled with respect to the Assembly Reference Orientation.	A2222132 A2222142
**Analysis Quality/Completenes s	An assessment of the quality of the finite element model (convergence, etc.), and of the completeness of the stress analysis of the part.	?
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
**Laminate Patch	A constant thickness area of a ply laminate.	A223352132
STRUCTURAL TEST - PLY LAMINATE (GENERAL FLAT)		
Boundary	The location of the outer contiguous flat perimeter of a General Flat Ply Laminate.	A2233541
Laminate Thickness(es)	The theoretical cured laminate thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A2233541
OML/IML Surface	The surface that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Flat Ply Laminate.	A2233541
Test Results	The results of structural tests preformed on a General Flat Ply Laminate.	A2233543
Weight	The weight of the General Flat Ply Laminate.	A2233543
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A2233541
Next Assembly Information	References to the attachment of the part to adjoining parts.	A2233541

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Laminate Properties	The as tested mechanical Laminate Properties of the various Laminate Thicknesses of the General Flat Ply Laminate.	A2233543
Reference Orientation	The basic orientation direction of the General Flat Ply Laminate relative to an established coordinate system.	A2233541
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A22335 1
STRUCTURAL TEST - PLY LAMINATE (GENERAL CONTOUR/WRAPPABLE)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a General Contour/Wrappable Ply Laminate.	A2233541
Laminate Thickness(es)	The theoretical cured Laminate Thicknesses that are a sum of the Ply thicknesses specified in the Ply Table.	A2233541
Contoured OML/IML Surface(s)	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of the General Contour/Wrappable Ply Laminate.	A2233541
Test Results	The results of structural tests preformed on a General Contour/Wrappable Ply Laminate.	A2233543
Weight	The weight of the General Contour/Wrappable Ply Laminate.	A2233543
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A2233541
Next Assembly Information	References to the attachment of the part to adjoining parts.	A2233543
Laminate Properties	The as tested mechanical Laminate Properties of the various Laminate Thicknesses of the General Contour/Wrappable Ply Laminate.	A2233541

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Reference Orientation	The basic orientation direction of the General Contour/Wrappable Ply Laminate relative to an established coordinate system.	A2233541
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
STRUCTURAL TEST - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A2233541
OML/IML Surfaces	The surface(s) that define the Outer Mold Line (OML) or Inner Mold Line (IML) of a bond tool surface of a Composite Assembly.	A2233541
Test Results	The results of structural tests preformed on a Composite Assembly.	A2233543
Weight	The weight of the Composite Assembly.	A2233543
Combined Material Properties	The as tested smeared (equivalent) mechanical Material Properties of the Composite Assembly.	A2233543
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A2233541
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351
STRUCTURAL TEST - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE) / PLY LAMINATE (ANGLE) / FILAMENT LAMINATE (RADIUS FILLER)/ PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Joints	Description of the attachment mechanisms (e.g. bolts, adhesives, etc.) and structural configuration//members joined together to transfer load.	A2233541
Next Assembly Information	References to the attachment of the part to adjoining parts.	A2233541
Cross Section Properties	The as tested beam bending properties of the Composite Assembly cross section (moments of inertia, etc.)	A2233543
Test Results	The results of structural tests preformed on a Composite Assembly.	A2233543
Weight	The weight of the Composite Assembly.	A2233543
Boundary/Envelope	The location of the outer contiguous three-dimensional perimeter of a Composite Assembly.	A2233541
Reference Orientation	The basic orientation direction of the Composite Assembly relative to an established coordinate system.	A2233541
**Configuration Control Data	Information such as effectivities, contract, drawing, serial, and part numbers.	A226
*Analysis Decision Data	Data that records the decisions and idealizations made during the stress analysis.	A223351

* Additions required by activities
** Additions required by AP scope

APPENDIX D - Manufacturing Refined Information Needs

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
MANUFACTURING PLANNING - FILAMENT ASSEMBLY (FABRIC/TAPE/TOW)		
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	A2315
Material Thickness	The nominal thickness of one layer of the material.	A2315
Weave	The manner in which the a fabric is formed by interlacing yams in a specific pattern.	A2315
Drape	The ability of a material to form to a contour	A2315
Material Name	The manufacturer of the material and any brand name and/or product identifier.	A2315
Fiber/resin ratio	The ratio between the fiber content and the amount of resin present in a composite material. Determine requirements for bleeding.	A2315
Warp/Fill Directions	The direction of the longitudinally oriented yam in a woven fabric./ The yam in a fabric that crosses the warp.	A2315
Fiber Strength/Stiffness	The ability of the tape fibers to resist bending.	A2315
Material Life Data	The storage requirements, shelf life, working life, and out time limits for the materials	A2315
Stock Size	Physical dimensions describing material as it is purchased.	A2315
MANUFACTURING PLANNING - FILAMENT LAMINATE (RADIUS FILLER)		
Material Name/Description	The manufacturer of the material and any brand name and/or product identifier.	A2315
Material Quantity	The amount (number of strands of tow) required to produce the required cross section of the filler.	A23151,A2153
Cross Section Volume	The volume of a cross section of the filler.	A23151,A23153

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Boundary	The cross sectional shape and length of the filler.	A23151,A2353
Material Life Data	The storage requirements, shelf life, working life, and out time limits for the materials	A2315
Material Amount	The total quantity of material to produce filler.	
MANUFACTURING PLANNING - PLY PIECE		
None		
MANUFACTURING PLANNING - PLY		
Boundary	The edge of the ply detail (EOP).	A2315
Filament Laminate Characteristics	Inherit characteristics of Filament Laminate	A2315
Material Amount	The total quantity of material to produce	A2315
MANUFACTURING PLANNING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	A2315
Number of ply(ies)	How many ply(ies) make up this ply laminate.	A2315
Ply Table	Information on the position and orientation of each ply.	A2315
Boundary	The edge of the laminate.	A2315
Tolerances	The tolerance requirements relative to the ply laminate.	A2315
Splice, lap & gap	The requirements for splice location and overlapping/gaps in plies.	A2315
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	A2315

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Contour	A geometric definition of the surface of the laminate (may or may not be flat). The amount of contour is defined by the deviation of the laminate from a planar surface.	A2315
Mfg Concept	General definition of how to produce	A2315
Mfg BOM	Manufacturing Defined Bill of Materials	A2315
MANUFACTURING PLANNING - CORE (PROCESSED - MACHINED)		
Boundary	The edge of the core.	A2315
Core Splice	The location of the splice where the core will be attached to another core.	A2315
Core Thickness	The finished thickness of the core.	A2315
Core Density	The pounds per cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	A2315
Ramp Angle	The angle of segments of the core that are tapered.	A2315
Joints	The general area of contact.	A2315
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	A2315
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	A2315
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	A2315
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	A2315
Mating Surface Contour	The contour (see above) of the mating surface to the core.	A2315
Mfg Concept	General definition of how to produce	A2315
Material Amount	Definition of amount of stock material to produce	A2315

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
MANUFACTURING PLANNING - CORE (PROCESSED - ASSEMBLY)		
Core (Processed - Machined) Characteristics	Inherit the characteristics of the machined core	A2315
Adhesives	Identity of the adhesives that will be used to assembly the details.	A2315
Potting Compounds	Identity of the potting compounds that will be used.	A2315
Stabilizers	Identity of the stabilizers that will be used.	A2315
Boundary	The outside edge of the core assembly.	A2315
Core Position	The position of the details that make up the assembly. Includes location and orientation.	A2315
Core Assembly Tolerances	The orientation and positional tolerances for the assembly.	A2315
Core Assembly Surface Contour	The relative contour of the surface of the core assembly.	A2315
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	A2315
Mfg Concept	General definition of how to produce	A2315
MANUFACTURING PLANNING - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	Inherit characteristics from the core assembly.	A2315
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A2315
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	A2315
Adhesives (type)	The type of adhesive being used and its thickness.	A2315
Boundary	The size and shape of the core stiffened panel.	A2315

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	A2315
Mfg Concept	General Definition of how to produce	A2315
Mfg BOM	Manufacturing defined Bill of Materials	A2315
MANUFACTURING PLANNING - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE)/PLY LAMINATE (ANGLE)/FILAMENT LAMINATE (RADIUS FILLER)/PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A2315
Reference Orientation	The orientation of the laminates and filler relative to the tool.	A2315
Adhesives (type)	The identify of any adhesives required in the layup and the thickness.	A2315
Boundary	The dimensions of the completed assembly.	A2315
Mfg Concept	General definition of how to produce	A2315
Mfg BOM	Manufacturing defined Bill of Materials	A2315
Location Tolerances	The positional accuracy required for the completed assembly.	A2315
NC PROGRAMMING - FILAMENT ASSEMBLY (FABRIC/TAPE)		
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	A233211,A233212, A233213,A233214
Material Thickness	The nominal thickness of one layer of the material.	A233211, A233212, A233213, A233214
Material Stock Size	The form in which the material will be purchased. Such as 12" wide tape on a 120' roll. This is an output of the mfg plan.	A233211, A233212, A233213, A233214
Material Name	The manufacturer of the material and any brand name and/or product identifier.	A233211, A233212, A233213, A233214

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Warp/Fill Directions	The direction of the longitudinally oriented yarn in a woven fabric./ The yarn in a fabric that crosses the warp.	A233211, A233212, A233213, A233214
Fiber Strength/Stiffness	The ability of the tape fibers to resist bending.	A233211, A233212, A233213, A233214
NC PROGRAMMING - FILAMENT LAMINATE (RADIUS FILLER)		
None		
NC PROGRAMMING - PLY PIECE		
Boundary	The geometric data describing the EOP.	A233211, A233212, A233213, A233214
Warp	The warp direction of the material.	A233211, A233212, A233213, A233214
Fiber Orientation	The orientation of the fabric within the ply detail.	A233211, A233212, A233213, A233214
Tolerance	The accuracy of the dimensions required when producing the ply detail.	A233211, A233212, A233213, A233214
Ply it is Part of	The identity of the parent ply.	A233211, A233212, A233213, A233214
NC PROGRAMMING - PLY		
Boundary	The edge of the ply detail (EOP).	A233211, A233212, A233213, A233214
OML/IML	Identify if the ply is IML or OML.	A233211, A233212, A233213, A233214
Ply location in stack	The location of the ply within the stack.	A233211, A233212, A233213, A233214
Filament Assembly Characteristics	Inherit characteristics of Filament Assembly	A233211, A233212, A233213, A233214
		A233211, A233212, A233213, A233214

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
NC PROGRAMMING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	A233211, A233212, A233213, A233214
Laminate Thickness	The thickness of the laminate.	A233211, A233212, A233213, A233214
Boundary	The edge of the laminate.	A233211, A233212, A233213, A233214
Tolerances	The tolerance requirements relative to the ply laminate.	A233211, A233212, A233213, A233214
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	A233211, A233212, A233213, A233214
NC PROGRAMMING - CORE (MACHINED)		
Boundary	The edge of the core (material).	A233211, A233212, A233213, A233214
Core Thickness	The finished thickness of the core.	A233211, A233212, A233213, A233214
Core Density	The pounds pe cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	A233211, A233212, A233213, A233214
Ramp Angle	The angle of segments of the core that are tapered.	A233211, A233212, A233213, A233214
Joints	The general area of contact.	A233211, A233212, A233213, A233214
Material Stock Size	The length and width of the material as it comes from the vendor.	A233211, A233212, A233213, A233214
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	A233211, A233212, A233213, A233214
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	A233211, A233212, A233213, A233214

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	A233211, A233212, A233213, A233214
Mating Surface Contour	The contour (see above) of the mating surface to the core.	A233211, A233212, A233213, A233214
NC PROGRAMMING - CORE (PROCESSED - ASSEMBLY)		
None		
NC PROGRAMMING - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE CORE STIFFENED PANEL)		
None		
NC PROGRAMMING - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (ANGLE)/PLY LAMINATE (ANGLE)/FILAMENT LAMINATE (RADIUS FILLER)/PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
None		
PROCESS PLANNING - FILAMENT ASSEMBLY (FABRIC/TAPE)		
Material Type/Description	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	A23215
Warp/Fill Direction	The direction of the longitudinally oriented yarn in a woven fabric./ The yarn in a fabric that crosses the warp.	A23215
PROCESS PLANNING - FILAMENT LAMINATE (RADIUS FILLER)		
Material Quantity	The amount (number of strands of tow) required to produce the required cross section of the filler.	A23215
Cross Section Volume	The volume of a cross section of the filler.	A23215

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
		A23215
PROCESS PLANNING - PLY PIECE		
Boundary	The geometry of the edge of the ply.	A23215
Warp/Fill Direction	The warp direction and whether its position is relevant.	A23215
Tolerance	The accuracy required when producing the ply.	A23215
Ply it is a Part of	Which ply contains this detail.	A23215
Filament Assembly Characteristics	Inherit the Filament Assembly characteristics.	A23215
		A23215
PROCESS PLANNING - PLY		
Boundary	The edge of the ply (EOP).	A23215
Ply Piece Characteristics	Inherit characteristics of Ply Piece	A23215
Splice, Laps & Gap	Information about where and what type of splices are allowed and the allowable gaps and overlaps.	A23215
Tolerance	The accuracy required when producing the ply.	A23215
Number of Ply Pieces	How many ply piece make up ply.	
OML/IML	Any special requirements for the OML/IML plies.	A23215
Tooling Requirements.	A listing of the tools required to produce or layup the ply.	A23215
		A23215
PROCESS PLANNING - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	A23215
Number of ply(ies)	How many ply(ies) make up this ply laminate.	A23215

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Ply Table	Information on the position and orientation of each ply.	A23215
Boundary	The edge of the laminate.	A23215
Tolerances	The tolerance requirements relative to the ply laminate.	A23215
Splice, lap & gap	The requirements for splice location and overlapping/gaps in plies.	A23215
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	A23215
OML/IML	Geometry of the OML/IML surfaces	A23215
Ply Drop Off	The locations of the ply drop offs within the laminate.	A23215
Ply Orientation	The orientation of the plies within the laminate.	A23215
Warp	The warp direction of the plies and if it is relevant to the layup.	A23215
Compaction	Instructions for the compaction requirements for this layup.	A23215
PROCESS PLANNING - CORE (PROCESSED - MACHINED)		
Boundary	The edge of the core.	A23215
Ramp Angle	The angle of segments of the core that are tapered. Used for illustration purposes only.	A232153
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb. Used for illustration purposes only.	A232153
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	A23215
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	A23215

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
PROCESS PLANNING - CORE (PROCESSED - ASSEMBLY)		
Core (Processed - Machined) Characteristics	Inherit the characteristics of the machined core	A23215
Adhesives (type)	Identity of the adhesives that will be used to assembly the details.	A23215
Potting Compounds	Identity of the potting compounds that will be used.	A23215
Stabilizers	Identity of the stabilizers that will be used.	A23215
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	A23215
		A23215
PROCESS PLANNING - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	Inherit characteristics from the core.	A23215
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A23215
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	A23215
Adhesives (type)	The type of adhesive being used and its thickness.	A23215
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	A23215
Tooling requirements	A listing of the tools required to layup the Core Stiffened Panel.	A23215
PROCESS PLANNING - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (ANGLE)/PLY LAMINATE (ANGLE)/FILAMENT LAMINATE (RADIUS FILLER)/PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A23215

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Reference Orientation	The orientation of the laminates and filler relative to the tool.	A23215
Adhesives (type)	The identify of any adhesives required in the layup and the thickness.	A23215
Location Tolerances	The positional accuracy required for the completed assembly.	A23215
Tooling requirements	A listing of the tools required to layup the 'T' stiffener.	A23215
Filler Characteristics	Inherit the characteristics of the filler.	A23215
Identification of Transferable Process Steps.	A description of the process steps that may be performed at more than one station (transferred).	A23215
TOOL DESIGN - FILAMENT ASSEMBLY (FABRIC)		
Material Type	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	A2331
TOOL DESIGN - FILAMENT ASSEMBLY (TAPE)		
Material Type	Define the type of material such as graphite, fiberglass, etc. Determine the manufacturing method required.	A2331
TOOL DESIGN - FILAMENT LAMINATE (RADIUS FILLER)		
Boundary	The cross sectional shape and length of the filler.	A2331
Manufacturing Process	A description of the manufacturing process that will be used to produce the radius filler.	A2331
TOOL DESIGN - PLY PIECE		

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
None		
TOOL DESIGN - PLY		
Boundary	The edge of the ply piece (EOP).	A2331
Filament Assembly Characteristics	Inherit characteristics of Filament Assembly	A2331
Tooling Requirements	A listing of the tools required to layup the ply.	A2331
OML/IML	Define whether the ply is OML or IML.	A2331
Cure Ply Thickness	The thickness of the ply when it is cured in this part configuration.	A2331
TOOL DESIGN - PLY LAMINATE		
Ply Characteristics	Inherit characteristics of ply	A2331
Ply Thickness	The thickness of the laminate after curing.	A2331
Boundary	The edge of the laminate.	A2331
Tolerances	The tolerance requirements relative to the ply laminate.	A2331
Tool Controlled Surfaces	The surfaces of the ply laminate that come in contact with tool surfaces for the purpose of controlling certain aspects of the laminate (dimensions, surface finish, etc.).	A2331
OML/IML	Geometry of the IML and OML surfaces.	A2331
TOOL DESIGN - CORE (PROCESSED - MACHINED)		
Boundary	The edge of the core.	A2331
Core Thickness	The finished thickness of the core.	A2331

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Core Density	The pounds per cubic foot of honeycomb core based upon the foil gauge or thickness and cell size.	A2331
Joints	The general area of contact.	A2331
Material Stock Size	The length and width of the material as it comes from the vendor.	A2331
Tolerances (thickness, location)	The degree of accuracy required when manufacturing the ACSP.	A2331
Ribbon Direction	The direction the strips of material that make up the cells of the honeycomb.	A2331
Core Type	The type of core being used (e.g., nomex, HFT, HRP, etc.)	A2331
Core Configuration	The configuration of the cells (i.e., hex, flex, or over extended)	A2331
Mating Surface Contour	The contour (see above) of the mating surface to the core.	A2331
Tooling Requirements	A list of the tools required to layup the laminate.	A2331
TOOL DESIGN - CORE (PROCESSED - ASSEMBLY)		
Core (Processed - Machined) Characteristics	Inherit the characteristics of the machined core	A2331
Boundary	The outside edge of the core assembly.	A2331
Core Detail Position	The position of the details that make up the assembly. Includes location and orientation that will be used to mark reference directions on the tool.	A2331
Core Assembly Tolerances	The orientation and positional tolerances for the assembly.	A2331
Core Assembly Surface Contour	The relative contour of the surface of the core assembly.	A2331

* Additions required by activities
* Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Hard Detail Locations	The location of any hard details (fasteners, etc.) within the core assembly.	A2331
TOOL DESIGN - COMPOSITE LAYUP/ASSEMBLY (PLY LAMINATE (FLAT)/CORE/PLY LAMINATE - CORE STIFFENED PANEL)		
Core Characteristics	Inherit characteristics from the core.	A2331
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A2331
Reference Orientation	The orientation of the core and skins relative to the tool (rosette).	A2331
Boundary	The size and shape of the core.	A2331
Location Tolerances	The positional accuracy required for the core assembly in the final cured ACSP.	A2331
Tooling Requirements	A listing of the tools required to assemble the core.	A2331
Forecasted Part Quantities	The number of assemblies that will have to be built with this tool.	A2331
Next Assembly Information	The attachment points of the finished part to other parts.	A2331
TOOL DESIGN - COMPOSITE LAYUP ASSEMBLY (PLY LAMINATE (ANGLE)/PLY LAMINATE (ANGLE)/FILAMENT LAMINATE (RADIUS FILLER)/PLY LAMINATE (CAP) - "T" COMPOSITE ASSEMBLY)		
Ply Laminate Characteristics	Inherit characteristics from the ply laminates.	A2331
Reference Orientation	The orientation of the laminates and filler relative to the tool.	A2331
Boundary	The dimensions of the completed assembly.	A2331
Location Tolerances	The positional accuracy required for the completed assembly.	A2331
Tooling Requirements	A listing of the tools required to assembly this ACSP.	A2331

* Additions required by activities
** Additions required by AP scope

VIEW - COMPOSITE ITEM		Node Activity Reference
Characteristic	**Description**	**Activity Reference**
Next Assembly	The attachment points of the finished part to other parts.	A2331
Forecasted Part Quantities	The number of assemblies that will have to be built with this tool.	A2331
Assembly or Layup	Are any of the parts in the assembly process already cured?	A2331

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